LDS1000

Controller for Laser Diode Sensors

Newport®
Experience | Solutions

USER'S MANUAL

For Motion, Think Newport

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's discretion.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part.

CAUTION

The warranty does not apply to defects resulting:

- **from misuse**
  - **Different use from that intended by NEWPORT.**
  - **Use of a cable different to the one supplied by NEWPORT.**
  - **Use or storage in environmental conditions other than those indicated.**
  - **Poor maintenance of the equipment, in particular, scratches on the front optic, excessive humidity, shocks to the body.**
- **from any modification to the product or one of its parts.**

CAUTION

Please return equipment in the original (or equivalent) packing.

You will be responsible for damage incurred from inadequate packaging if the original packaging is not used.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

No part of this manual may be reproduced or copied without the prior written approval of Newport Corporation.

This manual has been provided for information only and product specifications are subject to change without notice. Any changes will be reflected in future printings.

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EC Declaration of Conformity

LDS1000

Controller for Laser Diode Sensors

Newport
Experience | Solutions

Year CE mark affixed: 2010

EC Declaration of Conformity

The manufacturer:

MICRO-CONTROLE Spectra-Physics,
1 rue Jules Guesde ZI. Bois de l'Epine - BP189
F-91006 Evry FRANCE

Hereby declares that the product:

Description: "LDS1000"
Function: Controller for Laser Diode Sensors
Type of equipment: Electrical equipment for measurement, control and laboratory use

– complies with all the relevant provisions of the Directive 2004/108/EC relating to electro-magnetic compatibility (EMC).
– complies with all the relevant provisions of the Directive 2006/95/EC relating to electrical equipment designed for use within certain voltage limits (Low Voltage)

– was designed and built in accordance with the following harmonised standards:
NF EN 61326-1:2006 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
NF EN 55011:2007 Class A
NF EN 61000-3-2:2006 +A1:2009 + A2:2009 « Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions »
NF EN 61010-1:2001 « Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements »

– was designed and built in accordance with the following other standards:
NF EN 61000-4-2
NF EN 61000-4-3
NF EN 61000-4-4
NF EN 61000-4-6
NF EN 61000-4-11

Date : 11/22/2010

Dominique DEVIDAL
Quality Director

MICRO-CONTROLE Spectra-Physics
Zone Industrielle
F-45340 Beaune La Rolande, France

DC2-EN rev:A

Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the product where safety-related issues occur.

General Warning or Caution

The exclamation symbol may appear in warning and caution tables in this document. This symbol designates an area where personal injury or damage to the equipment is possible.

European Union CE Mark

The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

WARNING

This controller is a Class A device. In a residential environment, this device can cause radioelectric interferences. In this case, suitable measurements must be taken by the user of this device.

Warnings and Cautions

The following are definitions of the Warnings, Cautions and Notes that may be used in this manual to call attention to important information regarding personal safety, safety and preservation of the equipment, or important tips.

WARNING

Situation has the potential to cause bodily harm or death.

CAUTION

Situation has the potential to cause damage to property or equipment.

NOTE

Additional information the user or operator should consider.

Warnings

WARNING

CERTAIN SAFETY PRECAUTIONS MUST BE RESPECTED BEFORE ANY INTERVENTION ON THE LDS1000 CONTROLLER.

IN ORDER TO COMPLY WITH SAFETY STANDARDS CONCERNING THE USE OF THIS EQUIPMENT, THE USER MUST TAKE THE FOLLOWING PRECAUTIONS AND RESPECT THE WARNINGS THAT APPEAR LATER IN THIS MANUAL.

WARNING: GROUNDING

LDS1000 is a PIECE OF EQUIPMENT DESIGNED TO BE CONNECTED BY A NON INDUSTRIAL PLUG:

- **User safety is ensured by grounding the equipment.**
- **The user must check the conformity of his electrical installation**
- **The equipment must be connected to the power supply with a CEE22-type cable that complies with the EN60950 standard.**

Contact your electrician to check the connections of your plugs.

All the sockets that are near your equipment must be equipped with a ground connection.

Any break in the ground connection can lead to an electric discharge .

WARNING: CONNECTING ADDITIONAL EQUIPMENT

Additional equipment can be connected to the LDS1000 Controller (computer, oscilloscope, etc.).

The connection cables carry VERY LOW VOLTAGE.

The user must make sure that the equipment connected and the cables used comply with EC standards.

WARNING: LDS SERIES SENSOR

The user must read the warnings in the LDS sensor manual before setting up the equipment.

The sensor must be connected to the LDS1000 Controller using a cable supplied by us and that has not been modified.

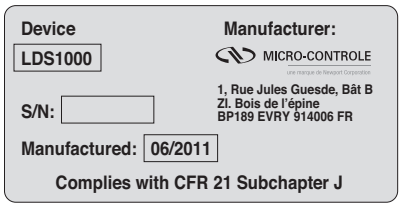
Connection and disconnection must never be carried out to equipment that is switched on.

CAUTION: LASER SAFETY

The LDS Series Sensor is a CLASS II LASER INSTRUMENTS according to the EN-60825-1 standard:

DO NOT STARE INTO BEAM

Max. Power <1 mW @ 670 nm



WARNING: DANGEROUS VOLTAGE

This equipment operates with a supply voltage that can be fatal.

Do not introduce any object into the controller and do not spill any liquid on the equipment as this could cause a short circuit.

Opening or removing the cover of the equipment exposes you to electric shocks.

Do not open the equipment. The parts that are inside are of no use to the user.

CAUTION: SAFETY REGULATIONS

Do not use the instrument in an explosive environment.

Make sure there is no liquid near the instrument.

Make sure that the instrument is not exposed to excessive humidity (more than 85%).

Do not replace any part and do not modify the equipment in any way

Should the equipment require servicing or repairs send it back to our head office.

WARNING: UNPLUGGING

Systematically disconnect the plug in all the following cases:

- **If the power supply lead or any other cable is damaged or frayed.**
- **If the mains socket is damaged in any way.**
- **If the equipment has been exposed to rain, to excessive humidity or if any liquid has been spilt on it.**
- **If the equipment has fallen or if the unit is damaged.**
- **If you think that the equipment requires servicing or repairing.**
- **When you clean the unit.**

NEWPORT SHALL NOT BE HELD LIABLE IF THE ABOVE-MENTIONED WARNINGS ARE NOT RESPECTED.

Controller for Laser Diode Sensors LDS1000

1.0 Introduction

This manual describes the operations and conditions necessary for the proper use and working of the NEWPORT LDS1000 Controller.

It also provides the basic maintenance operations that are useful to keep the instrument in good working order.

IMPORTANT

NEWPORT LDS series sensors are measuring instruments that provides results of measurements. The calibration certificate drawn up by NEWPORT for each delivery, or when an instrument is newly calibrated must ALWAYS be supplied with the sensor. It provides the values of the parameters that must be stored in the memory of the LDS1000 electronic controller so that the instrument gives accurate measurements. BEFORE any measuring operation, the operator must make sure that the parameters that are used by the electronic controller are the ones that the instrument is designed to use. Refer to the corresponding chapter to check and modify the sensor parameters.

RECOMMANDATIONS

You are strongly advised to read the chapter entitled “First use” carefully before connecting your autocollimator.

2.0 Description

The LDS1000 Controller is designed to drive sensors of the NEWPORT LDS series (for example, LDS-Vector autocollimator or STR500-H rectitude sensor). The latter are compact and self-contained measuring instruments. The LDS1000 electronic controller provides the means of displaying angular variations by measuring the movement of a spot of light on a position sensing device. It has the capacity, off-line, to store up to 2048 measurements (14336 measurements with the extended memory option) and to calculate the averages of these measurements.

When linked to a personal computer it provides the possibility of processing and recording the measurements.

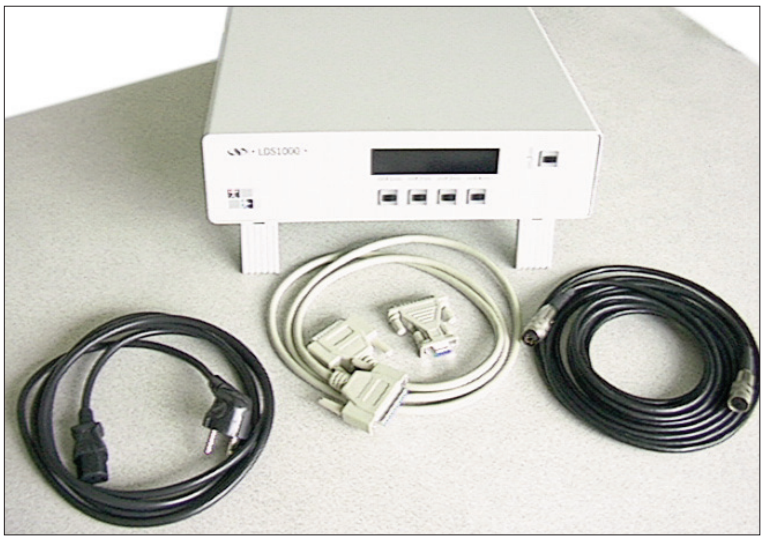
This manual is designed to facilitate the use of the LDS1000 Controller for all its modes of operation.

A dedicated user’s manual exists which describes and facilitates the use of the LDS-Vector sensor.

2.1 Equipment

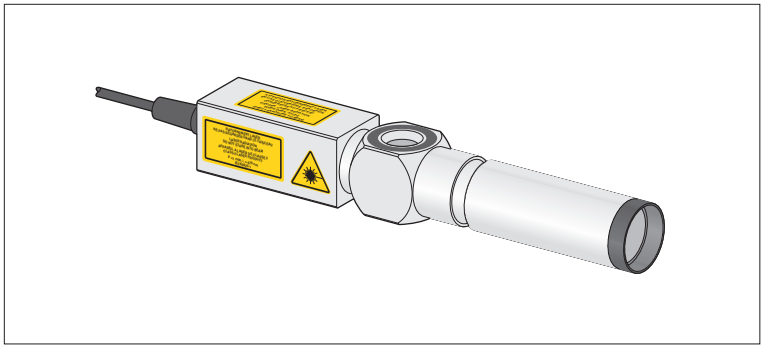
The LDS1000 electronic controller is delivered with:

- A RS-232-C lead.
- The present user's manual.
- The LDS-TOOLS Software.
- A connection cable (5 or 10 meters, depending on the order).
- As well as the extra accessories and options that may be ordered.



The sensor is delivered in a protection case which contains:

- The optical head.
- The control certificate.
- It's own user's manual.



2.2 Modes of Operation

Manual Mode

The LDS1000 Controller displays angular rotation values of the mirror on a frontal display screen. The operator uses the display and the active buttons on the front panel to:

- Read the measurements.
- Modify the integration constant.
- Define the zero point.
- Program the parameters of the connected sensor.
- Modify the communication parameters (RS-232-C or IEEE-488).
- Activate the analog outputs where available.

Refer to the chapter entitled: "Off-line use".

Remote Mode

When linked to a computer by RS-232-C or IEEE-488 connection, the LDS1000 Controller communicates by ASCII messages. The buttons on the front panel of the controller are no longer valid.

The following functions are possible:

- Reading the controller's programmed parameters.
- Modification of the integration constant.
- Transmission of instantaneous values measured.
- Acquisition in the controller's internal memory, of a number N of points, at the frequency F.
- Acquisition in the controller's internal memory, of a number N of points, at the frequency F, the beginning of the acquisition is started by an external signal (Trigger).
- Acquisition in the controller's internal memory of a number N of points, each acquisition being started by an external signal (Trigger).

Refer to the chapter entitled: "Use with a computer interface".

Analog Mode

Analog outputs are only available on models that are equipped with this option. This must be specified at the time of ordering.

There are two voltages at the analog outputs that are respectively proportional to the angular measurements Y and Z of the equipment.

This enables:

- Connection to an analog acquisition chain.
- Visualization of positions on an oscilloscope.
- Use of the LDS-Vector autocollimator for analog controls.

These outputs are obtained by a digital/analog conversion of the values calculated by the controller.

This conversion is carried out in real time at a frequency of 2000 Hz.

Refer to the chapter entitled: "Off-line use".

2.3 Available Versions

Controller

The electronic controller is available in eight versions that offer different measuring possibilities. The references are as follows:

LDS1000 Controller			**LDS1000-OPT BB CC**
with:	**BB**	**NN**	No cable.
		01	Cable length 5 meters.
		02	Cable length 10 meters.
	CC	**NN**	No controller.
		02	Standard controller European standard (220V, 2 manuals and EU cable).
		12	Analog option controller, EU standard.
		22	14K memory option controller, EU standard.
		32	2-option controller, EU standard.

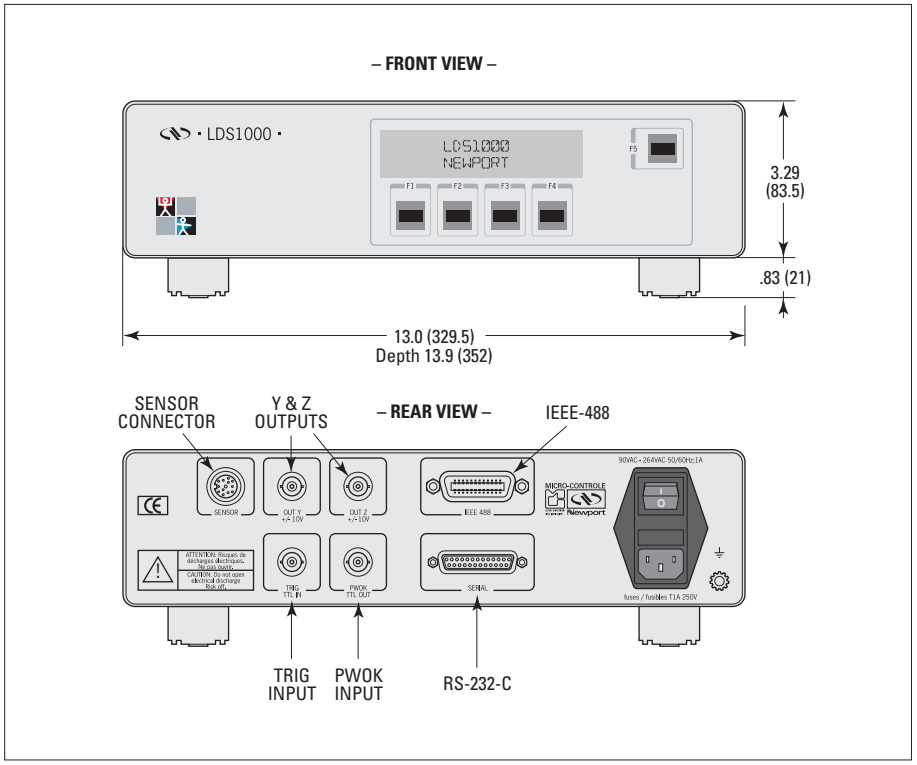
Sensor

Autocollimator, bilingual user's manual	**LDS-Vector**

Accessories and Additional Equipment Kits

Calibration blade kit, with certificate	**LDS-CAL01**
2-theta adjustable mount	**LDS-SL**
2-theta + XY adjustable mount	**LDS-SLXY**
4 movement adjustable mount on X26 (complete, for LDS-Vector)	**LDS-X26-V**

2.4 Dimensions



3.0 Principle of Operation

3.1 Laser Diode Sensors

The emission is performed by a Laser diode controlled and modulated at 10 kHz.

The reception is performed by a position sensing device that provides analog voltages.

From the electronic controller's point of view, that becomes:

- Supply the necessary power to the laser diode and to the pre-amplifying electronic controller.
- Monitor break down and defects.
- Collect the return signals from the analog sensor.

This data is processed by the controller, corrected according to the parameters provided by calibration and usable depending on the different modes (display, memorization, transmission to the computer interface, analog output [available as an option]).

3.2 Electronic Controller

The LDS1000 Controller performs:

- Fast acquisition at a set frequency of 2 kHz.
- Analog to digital conversion.
- Correction and integration calculation.
- Memory and display management.

Its technology is based on a 68000, 16 MHz microprocessor.

This controller offers a clear display of the values measured on a luminous screen and communication via RS-232-C and IEEE-488 interfaces.

One particular model is available with calibrated analog outputs, that are proportional to the values measured.

4.0 Specification

The LDS1000 electronic controller works with the LDS-Vector electronic autocollimator. Characteristics of the optical head are given in the individual manuals.

The measurement results can only take on their full meaning in relation to a unit that represents the value to be measured (distance, angle…). The controller enables the result to be displayed on the unit that corresponds to the sensor used.

4.1 General Characteristics

LDS-Vector Optical Head

- Wavelength 670 nm
- Peak power <1 mW
- Modulation 10 kHz
- Beam diameter 31 mm
- Beam direction <0.5 mrad in relation with autocollimator body
- Equivalent focal length 280 mm
- Beam divergence 0.1 mrad
- Ocular field ±15 mrad
- Measurement range ±2000 µrad
- Weight 1.065 kg

LDS1000 Controller

- Microprocessor 68000 (32 bits - 16 MHz)
- Display 2 x 20 characters, adjustable brightness
- Interfaces RS-232-C and IEEE-488
- Measurement memory 2048 spots or 14336 spots depending on the option
- Analog output Available as an option
- TTL TRIGG input Measurement synchronization
- TTL PWOK output Beam signal
- Power supply 90/264 VAC, 50/60 Hz
- Consumption 30 VA

Measurements

- Digital resolution 0.1 µrad
- Measurement range ±2000 µrad
- Measurement error ± (1 ±0.02 x measurement.) µrad (i.e. ±2%)
- Max. measuring noise 0.02 µrad/√Hz
- Sampling frequency 2000 Hz
- Digital integration from 0.5 msec to 1 sec

Environment

The performances of an optical sensor greatly depend on the conditions in which it is used.

The contractual characteristics are specified in the manual that goes with each sensor of the LDS series.

The operating limits of the LDS1000 Controller are the following:

- Operating temperature +15 °C to +25 °C
- Humidity 10% to 80%
- Storage temperature -10 °C to +50 °C

Refer to the paragraph entitled “Specification Validity” in each user’s manual for the performances of the sensors according to the conditions of use.

RS-232-C and IEEE-488 Interfaces

RS-232-C interface

Baud rate 300 to 19200

IEEE-488 interface

Mode SRQ management

Analog Outputs

Analog outputs are only available if the option has been chosen.

- Refresh frequency 2000 Hz
- Digital low-pass filter 1 to 2000 Hz
- Output range ±10 V
- Scale factor 5 mV/incr to 1000 mV/incr
- Resolution 0.5 increment
- Electronic noise 1 mV rms
- Distortion 0.5% (electronic)
- Maximum Offset 50 mV typical
- Output impedance 10 Ω
- Discrepancy equivalent to a pure delay of 1.1 msec (without integration).
- Attenuation equivalent to the one of an order 1 low-pass filter with 600 Hz cutoff frequency.

WARNING: SPECTRAL WITHDRAWAL

The analog outputs use an intermediary calculation stage that is based on a sample at 2000 Hz. This will limit the use of the LDS sensor for studying signals that do not have a significant spectral component over 1000 Hz (this sort of component would find themselves “withdrawn” and would appear for lower frequencies).

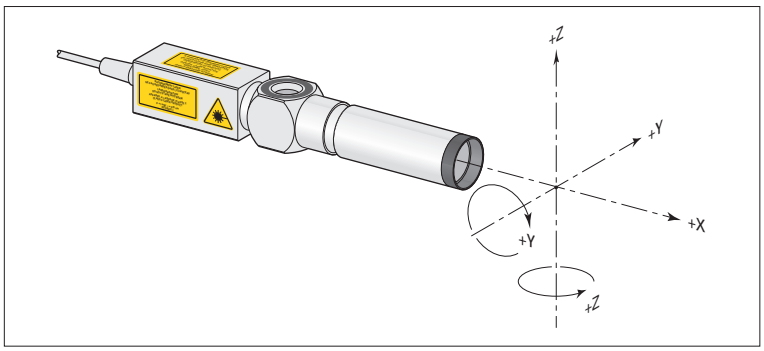
4.2 Validity of Specifications

Refer also to the paragraph entitled “Specification Validity” in each user’s manual for the performances of the sensors according to the conditions of use.

Calibration

A reading of the linear errors according to the angle measured is provided with each sensor. This calibration certificate gives, in particular, the value of the principal parameters to be used to configure the LDS1000 electronic controller:

- **S/N**: Series number of the optical head.
- **Type**: RT (Rotation) for LDS-Vector.



X: Beam Axis; Y: Horizontal Axis; Z: Vertical Axis.

  - **Type RT** (Rotation):
    Y: Rotation around Y axis.
    Z: Rotation around Z axis.
  - **Type TR** (Translation):
    Y: Parallel translation with Y axis.
    Z: Parallel translation with Z axis.
- **Ycoef:** Linear correction factor for axis Y.
- **Yincr:** Count increments for axis Y.
- **Yunit:** Unit displayed for axis Y.
- **Yofs1, Yofs2:** Channel Y electronic offsets.
- **Zcoef:** Linear correction factor for axis Z.
- **Zincr:** Count increments for axis Z.
- **Zunit:** Unit displayed for axis Z.
- **Zofs1, Zofs2:** Channel Z electronic offsets.

These parameters were optimized when the instrument was calibrated in order to obtain the best results. You are advised not to modify them without reason.

These parameters have been defined for the following conditions of use:

- Temperature 22 °C ±2 °C
- Mirror diameter >31 mm
- Reflectivity 80% at 670 nm
- Working distance 0.1 m

4.3 Noise Reduction

The LDS1000 Controller constantly carries out acquisitions at a rate of 2000 values per second.

These acquisitions are dealt with on request (transformation of electric signals into metrological values) for display or emission on a connection.

Depending on the programming of the electronic controller, the returned value corresponds either to the last acquisition carried out (no average) or to the average of the last N acquisitions.

In the second case, a low-pass digital selection is carried out which reduces the noise.

The noise reduction evolves like the square root of the number N of averaged samples, which is itself equal to the averaging time to acquisition period ratio.

The acquisition period is always equal to 0.5 msec (2 kHz).

The duration of the averaging is fixed by the integration constant that can be parametered INTG.

Refer to the user's manual of the LDS sensor concerned.

4.4 Offset Coefficient Adjustment

The Yofs1, Yofs2, Zofs1 and Zofs2 coefficients are normaly set to zero value.

When the reflected light is becoming low, because of poor reflectivity or small mirror aperture, it is necessary to take into account the value of the electronic offsets of the detector.

The LDS1000 Controller is designed to make this correction very easily, by introducing offset coefficients into its memory.

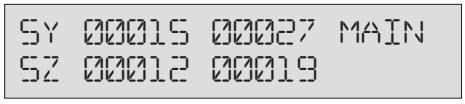
The following procedure must be accomplished:

❶ The values of offsets are reached when the instrument does not receive any light.

In order to get these values, place a black screen in front of the exit pupil of the instrument.

The requested values are then dispayed by the LDS1000 in the specific test mode, described in chapter 7.3.

MAIN => MENU (**F5**) => NEXT (**F4**) => TEST (**F2**)



The first line gives Yofs1 and Yofs2.

The second line gives Zofs1 and Zofs2.

❷ Take notes of these values and go to LDS1000 parameter setting, as explained in chapter 7.4.

5.0 Starting the Equipment

5.1 Setting Up

The setting up of the sensor is explained in each user's manual of the LDS instruments.

RECOMMANDATION

You are advised to read the user's manuals corresponding to each sensor delivered. They contain important information for optimal use of the instruments. These instructions can vary from one sensor to another.

Mounting

Small movement measurements require specific precautions as far as the quality of the mounting of the equipment is concerned. It is particularly important to make sure that the sensor, the reflector and their corresponding supports are solid

5.2 Electric Connections

CAUTION

Before connecting check that all equipment is switched off.

CAUTION

Do not use any cable other than the one supplied by NEWPORT.

The cable provided connects the sensor to the electronic controller. The male part should be connected to the optical head, the female part to the controller. Please ensure that all connections are correctly screwed in.

The cable is available in two standard lengths:

Cable for LDS1000, length 5 meters	**LDS1000-OPT01NN**
Cable for LDS1000, length 10 meters	**LDS1000-OPT02NN**

For longer lengths, please consult us.

A lead ensures the connection to the mains supply on a switch and fuse base.

The controller is equipped with a self-selecting input voltage power supply (from 90 V to 250 V).

Set the switch to "0" (OFF) position.

5.3 Power Up

Power Up Messages

Link up the controller to the mains. Set the switch to “I” (IN).

Once turned on, the controller goes into its initialization phase and displays a welcome message.

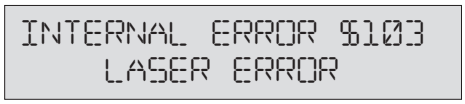
Then, the display of values measured according to programming parameters is displayed:

This presumes that the autocollimator is stationary in front of a mirror which sends the correct beam into the measuring range (see paragraph: “Alignment”).

In other cases, the controller displays the value of the limits of the measuring range (the most frequent being -2000 µrad) instead of the value measured on the given axis:

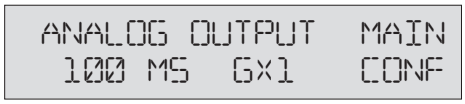
See paragraph: “Alignment”.

Other possible messages:



LASER ERROR: This message indicates a connection error in the optical head or a laser diode emission fault.

This message indicates that the controller is connected to a computer on which software is running, which has sent the command to freeze the display. Reset the software parameters to regain control.



This type of message indicates, for controllers equipped with analog options, that the analog output mode is active. Press the MAIN key to return to the main menu.

Alignment

To visualize an angular measurement, make sure that the return beam penetrates the LDS-Vector autocollimator and that the return energy is powerful enough.

The procedure for rapid set up is explained in the user’s manual supplied with each instrument.

6.0 Configuring the Equipment

The controller is configured in manual mode, using the buttons and the display available on the front panel of the LDS1000 Controller. This must be done before the instruments can be used.

6.1 Sensor Configuration

The LDS1000 electronic controller works with an LDS-Vector electronic autocollimator.

To simplify programming and to minimize the risk of errors, the LDS1000 electronic controller has a memory that can store all the parameters of 10 different sensors. Only Manual mode makes it possible to modify the number of the sensor being used, as this modification requires manual adjustment on the controller (physically connecting the sensor required).

To configure the sensor you will need to consult the control statement delivered with each piece of equipment. Should you lose it, a duplicate of this document which is of great importance is kept by our metrology department. Just note the number that is marked on the sensor and we will be able to send you a copy of the document.

The configuration of the sensor is carried out in manual mode and enables:

- The active sensor to be selected.
- The parameters of the active sensor to be visualized.
- The parameters of the active sensor to be modified.

See the chapter entitled: “Off-line use”.

6.2 Interface Configuration

Manual mode enables the parameters and the communication mode of the controller to be chosen. It is useful to check these values before proceeding with a connection to a computer. This must be done before using the instrument in Interface Mode.

The LDS1000 Controller communicates with a computer via two standard protocols available:

- RS-232-C.
- IEEE-488.

RS-232-C Interface

The RS-232-C protocol is available on most commercial computers on ports COM1 or COM2. The LDS1000 Controller is delivered with a RS-232-C lead comprising a classical Sub-D9 connector, as well as a Sub-D9/Sub-D25 adapter.

Depending on the standard chosen by the computer manufacturer, it is always possible to carry out the RS-232-C communication with the LDS1000 Controller. A program written on a given computer will be able to use the RS-232-C outputs available on another computer without any problems (on the condition that the right number of the port on which the LDS1000 Controller is connected is given).

The parameters of the RS-232-C interface are the following:

- BAUD RATE Interface speed.
- MSG TERM End of message character.
- WORD LENGTH Length of the transmitted chain.
- STOP BITS Number of stop bits.
- PARITY Parity used by the interface.

IEEE-488 Interface

The IEEE-488 protocol is only possible when the computer is equipped with a special card that allows IEEE-488 communication. There are several different models available on the market. Please note that they are not compatible between themselves. As a result, a software program written for a IEEE-488 card of a model will not work with another IEEE-488 card.

The parameters of the IEEE-488 interface are the following:

- MSG TERM End of message character.
- PRIM ADRESS Instrument's primary address.
- SECOND ADRESS Instrument's secondary address.
- TIME OUT Wait time.

The IEEE-488 interface enables several different instruments to be connected to the same computer input. It is quicker than the RS-232-C interface. For this connection, the controller operates in SRQ mode.

The parameters of the two communicating instruments must be identical to obtain the communication (in fact the two instruments must speak the same language in order to understand each other). The LDS1000 Controller is considered to be a slave in the communication protocol. Its parameters must therefore be chosen in accordance with those of the master computer.

Cf. Chapter entitled: "Off-line use".

6.3 Controller Configuration

The LDS1000 Controller has a program and material configuration that depends on the options chosen at the time of ordering. In particular, the internal software version, the size of the memory installed and the installation of the analog output option represent information that is accessible in manual mode.

Moreover, so that you can comfortably use the controller in different atmospheres, the brightness of the light can be adjusted.

Accessible functions:

- Reading the version.
- Display brightness.
- Memory size.
- Analog output option.

Refer to the chapter: "Off-line use".

6.4 Analog Output Configuration

The analog outputs are only available by manual mode on the models equipped with this option.

It is possible to modify the following parameters:

Refer to the chapter: “Off-line use”.

NOTE

The analog outputs deliver two voltages that are respectively proportional to the Y and Z measurements of the equipment.

Among other things this enables:

- Connection to an analog acquisition chain.
- Visualization of positions on an oscilloscope.
- Use of the sensor for analog controls.

These outputs are obtained by a digital/analog conversion of the values calculated by the controller.

This conversion is carried out in real time at a frequency of 2000 Hz. It imposes the following limits:

- Resolution limitation 0.5 increment
- Further measurement distortion 0.5%
- Extra noise 1 mV rms (measured with a load of 1 MΩ).
- Maximum offset 50 mV typical.
- Discrepancy equivalent to a pure delay of 1.1 msec (without integration).
- Attenuation equivalent to the one of an order 1 low-pass filter with 600 Hz cutoff frequency.

The output voltages take into account the averaging defined by INTG. The full scale voltage variation (±10 V) matches the full scale measurement variation, i.e. a scale factor of 5 mV/increment.

A multiplying factor defined by GAIN (1 to 200) makes it possible to change this scale factor from 5 to 1000 mV/increment. The gain comes with a limitation of the angular range that can be visualized (outputs limited at ±10 V).

The impedance of the outputs if equal to 10 Ω and the maximum current they can deliver is 4 mA.

7.0 Off-Line Use (Manual Mode)

The LDS1000 Controller has two modes of operation.

Manual mode which enables:

- The configuration of the controller in accordance with the parameters of the sensor used.
- To carry out measurements on values displayed.
- To modify the integration time, and the display mode.
- To parameter the communication interface.
- To select the analog outputs (if option available).

Interface mode which enables:

- Flying spot reading of values measured,
- Execution of acquisition sequences that are synchronized or not.
- Reading the sensor status.

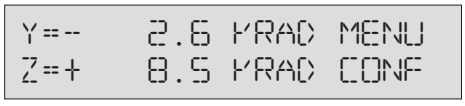
Manual mode is valid when the autocollimator is in off-line use, to perform measurements from the controller display. It is also used to parameter the computer interface or to access the analog outputs option (if it exists).

7.1 Access to Manual Mode

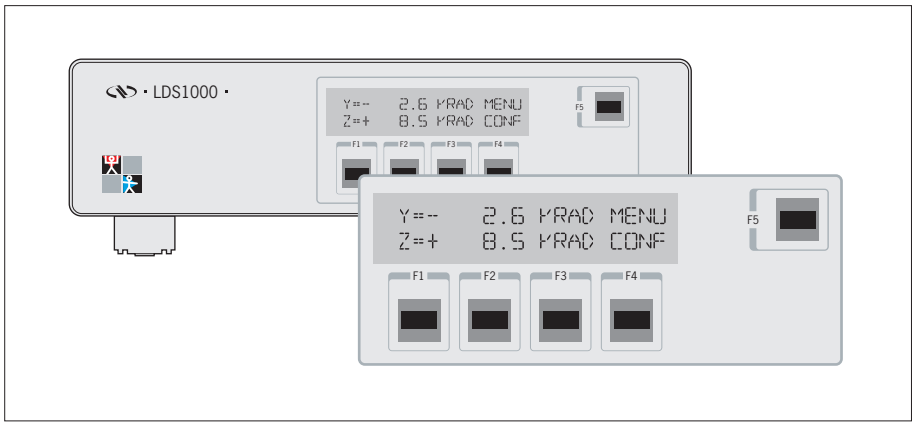
Manual mode is directly accessible on the controller at the time of Power up, except in the following cases:

- Sensor non connected or damaged (Laser error).
- Analog output mode valid (Refer to the corresponding chapter).
- Communication in progress via RS-232-C or IEEE-488 (Refer to the Interface Mode chapter).

The starting point is the main Menu which is the controller's usual mode of operation.



Access to the different Menus, parameter scrolling and the choice of values is obtained by pressing one of the 5 buttons on the front panel of the controller (F1 to F5).



Position of the buttons on the LDS1000 Controller.

The mnemonics corresponding to the function of each button are indicated by the display shown by the button.

For example, in the main menu MAIN, the **F5** key enables the function MENU to be selected, and the **F4** key selects the function CONF. The other keys **F1**, **F2** and **F3** have no effect.

WARNING

As a result the keys do not always correspond to the same functions.

7.2 Manual Mode Functions

The main menu gives access to two sub-menus:

- MAIN => MENU (**F5** key)

  Ce Mode permet l'accès aux fonctions suivantes:

  MEMO Display freeze.

  ZERO Display relative to a current position.

  GRAP Graphic display.

  INTG Modification of the integration constant.

  ILLU Display the light received.

  TEST Test Mode (maintenance).

- MAIN => CONF (**F4** key)

  This Mode gives access to the following functions:

  HEAD Reading/Modification of current sensor parameters. Memorization / Selection of 10 different sensor configurations.

  COMM Choice of communication parameters(RS-232-C, IEEE-488).

  RACK Information on the software version, the available memory and the display brightness.

  ANLG Commutation to analog outputs (only if the option exists).

The rolling menus use the following symbols and mnemonics:

EDIT Modification of current parameters.

VISU Visualization of current parameters.

NEXT Information on the software version, the available memory and the display brightness.

STO Reset with default values.

SET Save modifications (after EDIT).

YES Message confirmation.

NO Abandon.

››› Scrolling of modifiable parameters (or cursor movement).

+++ Next highest value (+1 for digital values).

---- Lower value (-1 for digital values).

MAIN Return directly to main Menu.

After any modification, the configuration will be saved when the equipment is switched off.

MASTER RESET

On switching on, if you press the F5 key for a few seconds, the controller suggests changing all the parameters to default values.

Selecting YES (**F4** key) will destroy all the data fed into the controller and will replace all values with default values.

7.3 Measuring Functions

Access to measuring functions, from the main menu, is done with the **F5** key:

MAIN => MENU (**F5**) => ...

Display Freeze

MAIN => MENU (**F5**) => MEMO (**F1**)

The display freeze is useful when carrying out measurements of a vibrating or moving system spread out over time. The display is frozen and the two values that correspond to the same instant are available on the screen.

It is therefore possible to read them without haste (this is a flying spot picture of a position).

MAIN (**F5**) Return to main menu.

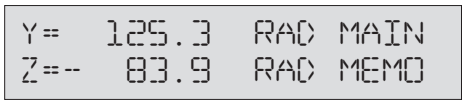
RUN (**F4**) Normal display.

MEMO (**F4**) Freeze the display.

Offset Origin

MAIN => MENU (**F5**) => ZERO (**F2**)

This mode, also called relative display, makes it possible to set the current point as the origin. The values displayed are therefore given in relation to this point. This mode is practical to find out the angular distance between two given positions, without having to adjust the zero point to the center of the sensor.



However, it is necessary to make sure that you do not go beyond the min. and max. limits on the cell. You are advised to set the first point near the center of the sensor.

MAIN (**F5**) Return to main menu.

MEMO (**F4**) Freeze the relative display.

RUN (**F4**) Relative display.

Integration Constant

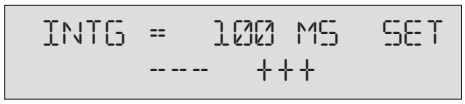
MAIN => MENU (**F5**) => INTG (**F3**)

The accuracy that can be obtained on a measurement depends on the number of readings carried out for that measurement.

In manual mode, the LDS1000 electronic controller carries out measurements at a frequency of 2 kHz. Its own resolution at this frequency is 0.8 µrad when using a standard LDS-Vector autocollimator.

By calculating the average of a large number of measurements, it is possible to obtain a much higher resolution, to the detriment of the system's pass band.

The LDS1000 Controller carries out a sliding average of N successive values, in relation to the INTG parameter that can be selected with this menu (N = 2 x INTG).



----- (**F2**) Lowest INTG value.

+++ (**F3**) Highest INTG value.

MAIN (**F5**) Return to main menu.

Possible values: INTG = 0,5; 1; 2; 5; 10; 20; 50; 100; 200; 500; 1000

Default value: INTG = 100

Unit: msec

Graphic Display

MAIN => MENU (**F5**) => NEXT (**F4**) => GRAP (**F3**)

In order to facilitate alignments, a display in the form of a Bar-Graph is recommended. For each axis, the number 8 digit is considered as the optical center of the autocollimator. The angles measured successively light up the adjacent digits (7 on each side), logarithmically for accurate alignment mode. Positive space values light up the digits to the right. The alignment around the center of the sensor is achieved by switching off as many digits as possible.

In alignment mode, a ZERO function (**F4**) enables measurements to be performed in relation to the current position which becomes a reference point.

MAIN (**F5**) Return to main menu.

Display Light Received

MAIN => MENU (**F5**) => NEXT (**F4**) => ILLU (**F1**)

To check if the instrument is working properly, make sure that the rate of light returned to the sensor is sufficient. This mode is especially useful for setting up the instrument in complex assemblies, in order to avoid substantial vignetting. The best results are obtained when a maximum amount of light is received.

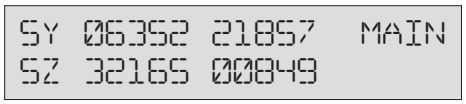
The display is in % in relation to the nominal value established at 100%.

MAIN (**F5**) Return to main menu.

Maintenance Mode

MAIN => MENU (**F5**) => NEXT (**F4**) => TEST (**F2**)

Here the brut value of the 4 channels of the analog/digital converter from the sensor is displayed. Interpreting the values depends on the sensor that is in place. Their read-out enables the sensor's electronic offset to be corrected.



MAIN (**F5**) Return to main menu.

7.4 Configuration Functions

Here we find the way to parameter the following elements:

- Parameter input of the sensor used.
- Parameter input of the controller.
- Interface parameter input.

Parameter Input of the Current Sensor or the Memorized Sensors

MAIN => CONF (**F4**) => HEAD (**F1**)

This mode displays the number of the current sensor (currently valid) and provides access to the following menus:

EDIT (**F1**) Modification of current sensor parameters.

VISU (**F2**) Visualization of current sensor parameters.

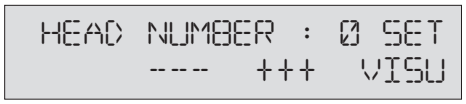
CHGE (**F3**) Choosing another current sensor.

MAIN (**F5**) Return to main menu.

Selecting the Number of the Current Sensor

MAIN => CONF (**F4**) => HEAD (**F1**) => CHGE (**F3**)

From this menu, it is possible to modify the number of the current sensor.



The display then takes into account the parameters associated with the number of the current sensor.

---- (**F2**) Previous number (-1).

+++ (**F3**) Next number (+1).

VISU (**F4**) Visualization of parameters of the sensor envisaged.

SET (**F5**) Save the new configuration.

Modification of Current Sensor Parameters

MAIN => CONF (**F4**) => HEAD (**F1**) => EDIT (**F1**)

Each NEWPORT sensor is delivered with a calibration certificate which enables the correct programming parameters for the LDS1000 Controller to be established.

This certificate gives the values of the following parameters:

S/N: Series number of the optical head.

A number is allocated to each sensor. It means it can be identified and its progress can be monitored.

Type: Y axis horizontal (TR) or vertical (RT).

This indication specifies the type of measurements carried out by the sensor. Thus RT, for rotation designates an autocollimator. This value is used by some programs for a correct display.

Ycoef, Zcoef: Linear correction factor for the axis Y or Z.

The sensor can be calibrated on a measuring bench. The given value of Ycoef or Zcoef minimizes linear errors in the direction concerned. It is a multiplying factor of the display.

Yincr, Zincr: Counter increment for the axis Y or Z.

The resolution of each sensor is limited by physical factors (electronic noise, enlargement, etc.). The value of Yincr or Zincr given is adapted to the sensor delivered. It is a multiplying factor of the display.

Different measurement limits correspond to each increment value:

0.1	-199.99	…	+199.99	5	-9999.5	…	+9999.5
0.2	-399.98	…	+399.98	10	-19999	…	+19999
0.5	-999.95	…	+999.95	20	-39998	…	+39998
1	-1999.9	…	+1999.9	50	-99995	…	+99995
2	-3999.8	…	+3999.8				

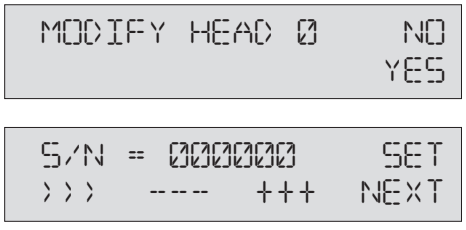
Yunit, Zunit: Unit displayed for the axis Y or Z.

It is the unit for which the sensor parameters are established.

Yofs1, Yofs2, Zofs1, Zofs2: Electric offset values.

These values enable the sensor resolution to be refined while taking into account a possible offset reading. The correct values are achieved in TEST mode.

In EDIT mode the values of the parameters stored for the current sensor can be modified. As a precaution, a confirmation message asks whether you really want to modify the current sensor (and specifies the number):



For all the parameters, a modification menu uses the following functions:

››› (**F1**) Scrolling of possible parameters (or cursor movement).

---- (**F2**) Lower value (-1 for digital values).

+++ (**F3**) Next highest value (+1 for digital values).

NEXT (**F4**) Next parameter.

SET (**F5**) Save and exit EDIT mode.

List of parameters:

	Designation	Available Values	Default Value
S/N	Series number of the optical head	6 digits: 000000 à 999999	000000
Type	Sensor type	Y axis horizontal (TR) or vertical (RT)	RT
Ycoef	Linear correction factor for Y axis	5 digits: 00100 to 29999	04000
Yincr	Counter increment for Y axis	0.1; 0.2; 0.5; 1; 2; 5; 10; 20; 50	1
Yunit	Unit displayed for Y axis	µrad; sec; mrad; nm; µm; mm; unit	unit
Yofs1 **Yofs2**	Electric offset values for Y	5 digits: 00000 to 32767	00000
Zcoef	Linear correction factor for Z axis	5 digits: 00100 à 29999	04000
Zincr	Counter increment for Z axis	0.1; 0.2; 0.5; 1; 2; 5; 10; 20; 50	1
Zunit	Unit displayed for Z axis	µrad; sec; mrad; nm; µm; mm; unit	unit
Zofs1 **Zofs2**	Electric offset values for Z	5 digits: 00000 to 32767	00000

The values displayed on the screen of the controller are obtained by the following calculation:

$$Y_{Displayed} = \frac{Y_{Calculated} \times (Ycoef \times 10 \times Yincr)}{10}$$

$$Z_{Displayed} = \frac{Z_{Calculated} \times (Zcoef \times 10 \times Zincr)}{10}$$

Display of Result in Arc-Seconds (LDS-Vector)

MAIN => CONF (**F4**) => HEAD (**F1**) => EDIT (**F1**)

The calibration certificate gives the values Ycoef, Zcoef, Yincr and Zincr for result display in µrad. In general, Yincr and Zincr are equal to 1. The resolution of the display is then 0.1 µrad.

To display the result in arc-sec:

1 arc-sec = 4.85 µrad

1 µrad = 0.2062 arc-sec

Thus: Y µrad = (0.20 x 1.0309 x Y) arc-sec

Thus we will use the increments Yincr = 0.2 and Zincr = 0.2. That gives display limits of -400 to + 400.

The values Ycoef and Zcoef are corrected by 1.0309:

$Ycoef_1$ = Ycoef x 1.0309 (rounded to the nearest unit).

$Zcoef_1$ = Zcoef x 1.0309 (rounded to the nearest unit).

The unit sec will be chosen.

You are advised not to delete the initial parameters, in µrad. You only need to program a new sensor number.

Programming a New Sensor

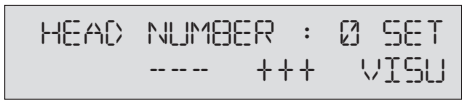
When an LDS-Vector autocollimator is delivered with its electronic controller, the sensor parameters are fed into the memory of the controller. The number 0 is used for the current sensor.

The other memories are normally empty, and the values of the parameters are therefore equal to the default values.

To program a new sensor, a spare place must be found, generally recognizable when S/N = 000000. You can choose to delete an existing sensor.

Access to the mode that enables rapid visualization of the various heads is obtained by the sequence:

MAIN => CONF (**F4**) => HEAD (**F1**) => CHGE (**F3**)



It is then possible to modify the number of the current sensor:

---- (**F2**) Previous number (-1).

+++ (**F3**) Next number (+1).

VISU (**F4**) Visualization of parameters of the sensor envisaged.

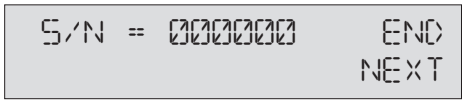
SET (**F5**) Save the new configuration.

Programming the new sensor is done by the EDIT menu (see modification of sensor parameters).

Visualization of Current Sensor Parameters

MAIN => CONF (**F4**) => HEAD (**F1**) => VISU (**F2**)

You are advised to check that the current sensor really matches the sensor that is currently connected to the controller. This Visualization mode is easily accessible and provides the explicit values of the current sensor parameters.



Check that the series number really matches that of the connected sensor. For more certainty, compare the values of the parameters to those given in the calibration certificate supplied with the sensor.

In case of nonconformity, it is necessary to:

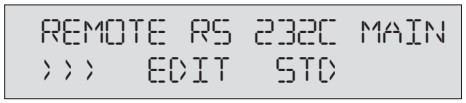
- Either find another number of the current sensor (especially if the series number does not match): CHGE Menu.
- Or modify the current sensor parameters: EDIT Menu.

Communication Parameter Input

MAIN => CONF (**F4**) => COMM (**F2**)

Access to this menu enables the parameters and the choice of communication mode of the controller to be modified. It is useful to check these values before connecting to a computer. This must be done before using the instrument in Interface Mode.

The COMM menu makes this selection possible in manual mode



This message indicates that the communication is programmed in RS-232-C. Access to the following functions is then possible:

>>> (**F1**) Changing RS-232-C <=> IEEE-488.

EDIT (**F2**) Modification of the parameters of the selected interface.

STD (**F3**) Change to default values of the selected interface.

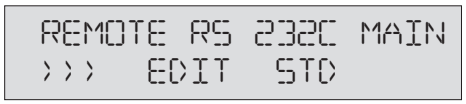
MAIN (**F5**) Return to main menu.

The communication mode can be modified from this menu using the >>> (**F1**) key.

Modification of RS-232-C Parameters

MAIN => CONF (**F4**) => COMM (**F2**)

The RS-232-C interface is active if the display is as follows:



Otherwise, the ››› (**F1**) key provides access to this menu.

In EDIT mode the values of the parameters stored for the RS-232-C interface can be modified.

For all the parameters, a modification menu uses the following functions:

››› (**F1**) Scrolling of possible parameters (and their status).

NEXT (**F4**) Next parameter.

SET (**F5**) Save and exit EDIT mode.

MAIN (**F5**) Return to main menu.

List of parameters:

	Designation	Available Values	Default Value
MSG TERM	End of sequence terminator	CR; LF; CR LF; LF CR	CR
BAUD RATE	Transmission Speed	300; 600; 1200; 2400; 4800; 9600; 19200	9600
WORD LENGTH	Length of the string sended	7; 8	8
STOP BITS	Stop bit number	1; 2	1
PARITY	Parity	NONE; ODD; EVEN	NONE

Modification of IEEE-488 Parameters

MAIN => CONF (**F4**) => COMM (**F2**)

The IEEE-488 interface is active if the display is as follows:

Otherwise, the ››› (**F1**) key provides access to this menu.

In EDIT mode the values of the parameters stored for the IEEE-488 interface can be modified.

For all the parameters, a modification menu uses the following functions:

››› (**F1**) Scrolling of possible parameters (or cursor movement).

---- (**F2**) Lower value (-1 for digital values).

+++ (**F3**) Next highest value (+1 for digital values).

NEXT (**F4**) Next parameter.

SET (**F5**) Save and exit EDIT mode.

MAIN (**F5**) Return to main menu.

List of parameters:

	Designation	Available Values	Default Value
MSG TERM	End of sequence terminator	CR; LF; CR LF; LF CR	CR LF
PRIM ADRESS	IEEE-488 primary adress	2 digits: 00 to 30	15
SECOND ADRESS	IEEE-488 secondary adress	2 digits: 00 to 30	00
TIME OUT	Communication time-out	0.01 to 10 sec	0.5

Default Values of Communication Parameters

MAIN => CONF (**F4**) => COMM (**F2**)

The communication programs available for the LDS1000 Controller use the communication parameter default values.

The LDS1000 Controller enables you to quickly return to the correct mode of operation when the parameter modifications do not allow the Interface Mode to be used normally.

For each communication mode, RS-232-C or IEEE-488, the STD (**F3**) key makes it possible to return to default values.

As a precaution, a confirmation messages asks if you really want to modify the current parameters (and specifies the active interface):

LDS1000 Controller Parameter Input

MAIN => CONF (**F4**) => RACK (**F3**)

Reading the Internal Software Version

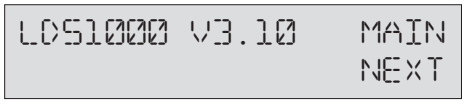
MAIN => CONF (**F4**) => RACK (**F3**)

This menu displays the version of the LDS1000 software installed in the controller.

This internal software manages all the controller's functions, in manual mode and in Interface Mode. It also operates the controller when analog outputs are installed. The physical modification of the software is done by EPROM exchange on the parent card of the 68000 processor.

Should you encounter any operating problems with the controller, this information will be useful to the maintenance service. It is possible to update the software as long as the material environment remains compatible with the working of the software.

Access to Menu Rack provides the following display:



The following functions are active:

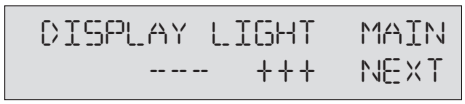
NEXT (**F4**) Access to next parameter.

MAIN (**F5**) Return to main menu.

Modification of Display Brightness

MAIN => CONF (**F4**) => RACK (**F3**) => NEXT (**F4**)

Four levels of brightness are available.



The following functions are active:

+++ (**F3**) Highest brightness.

---- (**F2**) Lower value.

NEXT (**F4**) Next parameter.

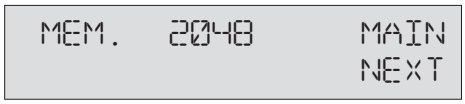
MAIN (**F5**) Return to main menu.

The maximum brightness is the default value.

Reading the Size of the Memory Installed

MAIN => CONF (**F4**) => RACK (**F3**) => NEXT (**F4**) => NEXT (**F4**)

The memory size depends on the option chosen at the time of ordering. It is the size of the buffer memory used for automatic acquisitions carried out by the LDS1000 Controller. This function is only accessible in Interface Mode. The values read by the sensor can be successively stored in the memory, at a high frequency.



The RS-232-C or IEEE-488 interface authorizes alternate reading of these values.

LDS1000 Controllers have a standard memory size of 2048 measurement points (couples Y, Z). Approximately 1 second of measurement can be stored at the maximum acquisition frequency of 2 kHz. The read-out time of these values depends on the communication transmission speed and the size of the host computer. For 2000 points, its value can reach several tens of seconds.

The extended memory option offers an extended memory of 14336 points. It enables an event to be stored in the memory the duration of which can reach 7 seconds at 2 kHz.

The display of this menu directly gives the values of the memory size expressed in the number of measurements that can be stored (one measurement is a couple of Y, Z values).

Reading the Analog Output Option

MAIN => CONF (**F4**) => RACK (**F3**) =>
NEXT (**F4**) => NEXT (**F4**) => NEXT (**F4**)

Only possible with controllers that have the analog output option.

The display of this menu shows whether this option is present on the controller concerned.

For more details on analog outputs, refr to the corresponding paragraph.

8.0 Analog Output Parameter Input

8.1 Selecting Analog Outputs (if option present)

MAIN => CONF (**F4**) => ANL_G (**F4**)

The analog outputs are a material option that must be specified at the time of ordering. They can be installed later on, but you will need to contact our after-sales service.

When the analog outputs are activated, the OUTY and OUTZ connectors located on the rear panel of the controller give two voltages that are proportional to the digital values calculated by the controller. The analog outputs take into account the real calibration performed on the current sensor and provide the reliable values that can be used directly. The refresh frequency of the analog outputs has been set at 2 kHz which enables events to be seized rapidly. Thus, when the analog outputs are active, the controller no longer manages the display, or the communication with the computer.

When the analog outputs have been chosen and the controller is switched off, the controller memorizes this status. When the controller is switched on, the analog mode is reactivated. The LDS1000 Controller operates like a standard analog instrument and can be perfectly integrated into classical acquisition chains.

The configuration parameters of the analog outputs are the following:

INTG: Integration constant (in msec).

Like the digital version, the value available at the output is obtained by a sliding average of a given number of values measured at maximum frequency. With this parameter a frequency filter adapted to the signals that you wish to obtain can be selected.

GAIN: Choice of output gain.

The output voltage is between -10 volts and +10 volts. When the gain is 1, the voltage of +10 V matches the highest limit of the measurement range. When the gain is 10, the same voltage only corresponds to a tenth of the highest limit of the measurement range.

With a gain of 1, the resolution of 1 increment supplies a voltage of 5 mV. It increases to 50 mV for a gain of 10.

The ANL_G (**F4**) menu provides access to the analog outputs that are immediately available on the rear panel. In addition, it displays the current parameters:

```
ANALOG OUTPUT   MAIN
 100 MS  GX1    CONF
```

The first value is the value of the integration constant used, the second value is the value of the gain.

Electric Characteristics of the Analog Outputs:

- Outputs on rear panel of controller: 2 connectors BNC OUTY and OUTZ
- Refresh frequency: 2000 Hz
- Low pass digital filter: 1 to 2000 Hz (depending on INTG)
- Output range: ±10 V
- Scale factor: 5 mV/incr (for Gx1) to 1000 mV/incr (for Gx200)
- Resolution: 0.5 increment
- Electronic noise: 1 mV rms
- Distortion: 0.5% (electronic)
- Maximum offset: 50 mV typical
- Discrepancy: Pure delay of 1.1 msec (outside integration)
- Output impedance: 10 Ω

WARNING: SPECTRAL WITHDRAWAL

The analog outputs use an intermediary calculation stage that is based on a sample at 2000 Hz. This will limit the use of the LDS sensor for studying signals that do not have a significant spectral component over 1000 Hz (this sort of component would find themselves "withdrawn" and would appear for lower frequencies).

The functions accessible by the ANL_G Menu are the following:

CONF (**F4**) Modification of analog output parameters.

MAIN (**F5**) Return to main menu.
Return to main menu disables the analog outputs.

8.2 Modification of Analog Output Parameters

MAIN => CONF (**F4**) => ANL_G (**F4**) => CONF (**F4**)

The integration constant INTG and the gain GAIN can be modified in this menu.

They will be chosen in relation to the type of measurements to be carried out:

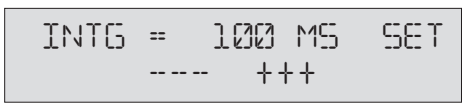
- Rapid measurements: Low integration value.
- Accurate measurements: Long integration value.
- Wide range: Low gain value.
- Reduced range: High gain value (Zoom).

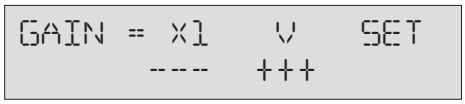
From this menu the active keys are the following:

INTG (**F1**) Modification of the integration constant.

GAIN (**F2**) Modification of the gain.

END (**F5**) Return to analog output mode.





For each of the parameters, a modification menu uses the following functions:

----- (**F2**) Lower value.

+++ (**F3**) Next highest value.

SET (**F5**) Save and Return to analog output mode.

List of parameters:

	Designation	Available Values	Default Value
INTG	Integration constant (msec)	0.5; 1; 2; 5; 10; 20; 50; 100; 200; 500; 1000	100
GAIN	Output gain Digital/Analog	1; 2, 5; 10; 20; 50; 100; 200	1

NOTE

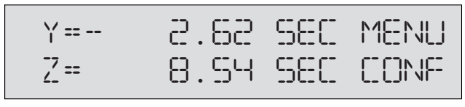
When you exit analog output mode after modifying the integration constant, the new value is also used to calculate the display of the controller.

Scale factors that correspond to the combined choice of the gain and the counter increment.

OUTY or OUTZ in mV for a Displayed Unit (µrad, sec, …)										
Incr.		0.1	0.2	0.5	1	2	5	10	20	50
Gain	1	50 mV	25 mV	10 mV	5 mV	2.5 mV	1 mV	0.5 mV	0.25 mV	0.1 mV
	2	100 mV	50 mV	20 mV	10 mV	5 mV	2 mV	1 mV	0.5 mV	0.2 mV
	5	250 mV	125 mV	50 mV	25 mV	12.5 mV	5 mV	2.5 mV	1.25 mV	0.5 mV
	10	500 mV	250 mV	100 mV	50 mV	25 mV	10 mV	5 mV	2.5 mV	1 mV
	20	1 V	500 mV	200 mV	100 mV	50 mV	20 mV	10 mV	5 mV	2 mV
	50	2.5 V	1.25 V	500 mV	250 mV	125 mV	50 mV	25 mV	12.5 mV	5 mV
	100	5 V	2.5 V	1 V	500 mV	250 mV	100 mV	50 mV	25 mV	10 mV
	200	10 V	5 V	2 V	1 V	500 mV	200 mV	100 mV	50 mV	20 mV
OUT (mV) = Measure (unit) x Gain/Incr. x 5										

Example: using the Table.

The controller operates in manual mode with a Yincr value of 0.2 and a unit given in arc-sec. The following values can therefore be read:



We can therefore expect to obtain the following analog values:

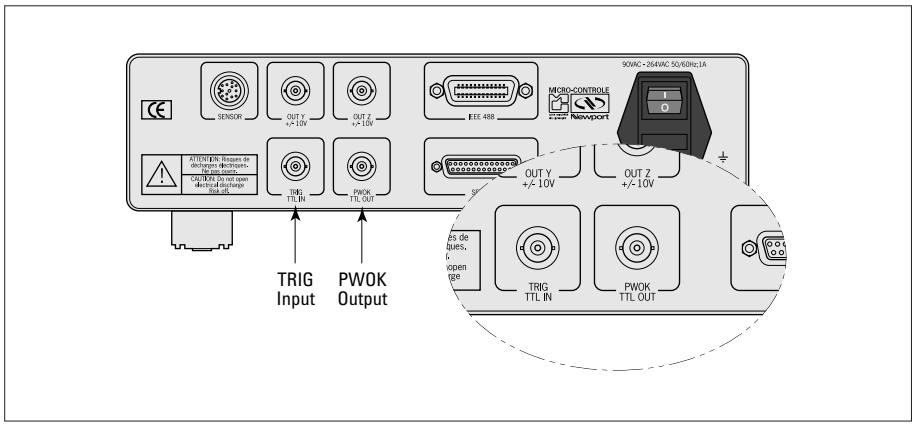
- With a gain of 1: OUTY = - 2.62 x 25 = - 65.5 mV
  OUTZ = 8.54 x 25 = 213.5 mV
- With a gain of 5: OUTY = -2.62 x 125 mV = - 327.5 mV
  OUTZ = 8.54 x 125 mV = 1067.5 mV

9.0 TRIG Input and PWOK Output

9.1 Conventions on Logical Inputs/Outputs

The controller has a logical TRIG input available on a BNC socket on the rear panel.

It provides a logical PWOK output that indicates if the sensor is receiving light.

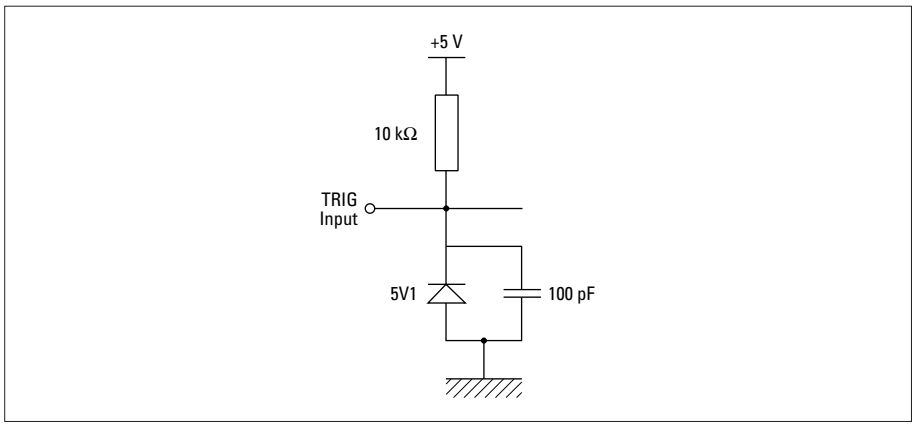


Logical Inputs/Outputs.

- The convention retained for logical inputs/outputs is the following:
  - ACTIVE = 1 = High Status = The current flows = Drawn at the ground.
  - PASSIVE = 0 = Low Status = The current doesn't flow = Open wire.
- The output (PWOK) is in High status (value 1) when the sensor receives light. With the RO command it is possible to read the status of this output.
- The passage of the TRIG input from Low status to High status (upward front) triggers the start of the synchronized acquisitions. With the RB command it is possible to read the status of this input.
- The wiring of the logical PWOK output to the logical TRIG input allows an acquisition cycle to be started when signal inputs into the measurement range of the sensor.
- Max. frequency PWOK: 130 Hz.
- Max. frequency TRIG: 500 Hz.
- The reading is performed with a random delay from 0 to 1 msec.

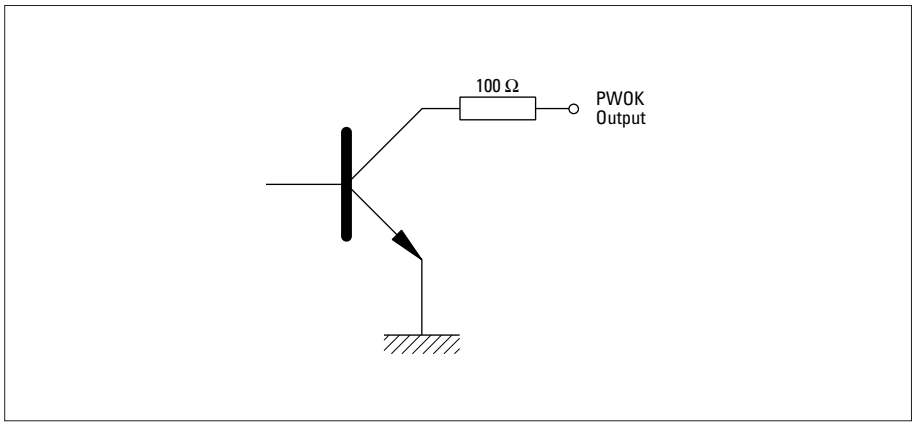
The logical inputs/outputs can only be used in Interface Mode.

9.2 TRIG Input



- Compatible TTL input.
- Max. voltage 5 V.

9.3 PWOK Output



- Open collector output.
- Max. voltage 30 V.
- Max. current 20 mA.

10.0 Use with a Computer Interface

The LDS1000 electronic controller offers its full measuring capacity when connected to a computer via an RS-232-C or IEEE-488 interface. Interface Mode is activated by sending a computer message. It can only be activated when:

- The physical connection between the controller and the computer is correct.
- The controller interface parameters and those of the computer are compatible.
- The correct computer output is commanded.
- The controller is in the main menu when the connection is established.

Interface Mode allows:

- Flying spot reading of the measured values.
- Execution of synchronous acquisition sequences of a clock inside the controller, or a logical external TRIG signal.
- Reading the sensor status and the I/O available.

The LDS1000 Controller is delivered with an RS-232-C cable. It will work for example with a PC computer with the following minimum configuration:

- A PC computer.
- An RS-232-C or IEEE-488 interface (Hewlett Packard or National Instrument card).

10.1 Checking the Interface

The controller must be connected to a calculator (RS-232-C or IEEE-488) or a console (RS-232-C) via an adapted cable. Only connect the instruments when everything is switched off.

WARNING

Before connecting, check that all equipment is switched off.

RS-232-C Interface

The LDS1000 Controller is delivered with an RS-232-C interface cable. This cable has a male Sub-D25 connector for the controller connection (cf. diagram). When setting it up, make sure you tighten the support screws.

The other connector is a Sub-D9 pin plug compatible with the series output of the computer. A Sub-D9/Sub-D25 pin adapter enables it to be linked to all existing standards. It is useful to note the series output of the computer: it is usually marked by one of the following: SERIAL, COM1, COM2, etc. (refer to the computer documentation).

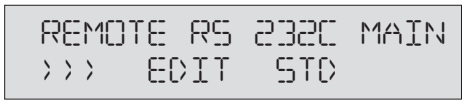
The communication must be obtained with a TERMINAL type program. Read the software documentation to configure the parameters of the RS-232-C output. It is recommended, as far as possible, to select the following parameters, that are the LDS1000 Controller's default parameters:

- BAUD RATE : 9600
- MSG TERM : CR
- WORD LENGTH : 8
- STOP BITS : 1
- PARITY : NONE

Start up the LDS1000 Controller and check, in Manual mode, the interface parameters by selecting the RS-232-C protocol.

MAIN => CONF (**F4**) => COMM (**F2**)

If the display is:



The RS-232-C interface is active (otherwise press the ››› (**F1**) key of the controller to return to the RS-232-C protocol).

Use EDIT (**F2**) mode to visualize and modify the interface parameters if necessary.

Return to the main display menu of the controller with the MAIN (**F5**) key.

The system is ready to communicate in RS-232-C.

RECOMMANDATION

Refer to the Appendix A: “Example of Program Using RS-232-C Link”.

IEEE-488 Interface

IEEE-488 interface is only possible if the computer is equipped with an IEEE-488 communication card. Several models are available on the market.

RECOMMANDATION

NEWPORT recommends the National Instrument AT-GPIB/TNT card for its software.

An IEEE-488 cable is required for the interface between the LDS1000 Controller and the IEEE-488 card. The cable is symmetrical and allows several instruments to be chained. This is the advantage of a parallel interface.

When setting up, make sure the support screws are properly tightened.

The communication must be obtained with a program. Read the software documentation to configure the parameters of the IEEE-488 output. It is recommended, as far as possible, to select the following parameters, that are the LDS1000 Controller’s default parameters:

- MSG TERM : CR LF
- PRIM ADRESS : 15
- SECOND ADRESS : 00
- TIME OUT : 0.5 sec

The controller operates the IEEE-488 interface in SRQ mode: the controller status can be read with the SPOL function of the IEEE-488 card. This status is coded by an 8 bits word, bit 7 of which (value 128) is worth 1 if a message is near: The reading must always be carried out before a new request.

Start up the LDS1000 Controller and check, in manual mode, the interface parameters by selecting the IEEE-488 protocol.

MAIN => CONF (**F4**) => COMM (**F2**)

If the display is:

The IEEE-488 interface is active. (Otherwise press the ››› (**F1**) key of the controller to return to the IEEE-488 protocol)

Use EDIT (**F2**) mode to visualize and modify the interface parameters if necessary.

Return to the main display menu of the controller.

The system is ready to communicate in IEEE-488.

RECOMMANDATION

Refer to the Appendix B: "IEEE-488 Link Characteristics".

10.2 LDS-TOOLS Software

In order to communicate with the controller, the user must have a terminal or a computer capable of communicating with external devices via a RS-232-C or IEEE-488 interface.

One approach is to use a communications software that can emulate a terminal. An other solution is to use NEWPORT software, Windows 3.11, Windows 95 and Windows NT compatible, and delivered with the LDS1000 Controller.

You can install this software on a PC compatible computer with the following minimum configuration:

- A Personal Computer or compatible.
- A VGA monitor.
- An 80386 or later processor.
- 4 MB of available memory (8 MB recommended).
- A hard disk with enough disk space to install the options you need.
- A Windows™ 3.1x environment.

LDS-TOOLS only accepts the following interfaces:

- COM1 or COM2 standard serial port.
- HP-IB Hewlett-Packard® board, model HPIB 82335.
- HP-IB Hewlett-Packard® board, model HPIB 82340.
- GPIB National Instrument® board, model AT-GPIB/TNT.

ATTENTION

Before to use NEWPORT LDS Tools software, IEEE-488 boards (listed above) must be into the initial configuration of the constructor, and installed in accordance with its recommended procedure.

Before to use NEWPORT LDS Tools software, we advise you to use softwares utilities supplyed with the IEEE-488 board to check that the installation is completed successfully.

This software enables you to quickly master the instrument in Interface Mode. You are able to promptly check if the communication is working correctly. It is a base for learning the basic functions of the LDS1000 Controller. Finally, it is used as a communication basis with LDS-Vector for a substantial number of applications.

This software will only work with controllers that have a software version higher than V3.00.

With the software the main functions of LDS instruments can be used:

- Display of the position by a moving spot on a target.
- Diameter of the variable target in relation to the spot position.
- Display of the position in large characters (Remote reading).
- Dialog with the controller, parameter modification.
- Point to point acquisition sequence, analysis and storage.
- Rapid acquisition sequence (max. freq. 2 kHz), analysis and storage.

10.3 Programming

Before we get to this chapter, we presume that the interface parameters have been checked, and that the connection is established. The LDS-TOOLS program is useful for checking the material configuration (refer to the previous chapters).

We will also presume that the first lines of the program contain adequate parameter commands that enable the computer interface to be configured in the mode chosen. The information on this point is contained:

- In the instructions for the programming software used (Basic instructions for example).
- In the manual of the computer used.
- Possibly in the instructions for the IEEE-488 card chosen.

Whichever protocol is used (RS-232-C or IEEE-488), the communication logic with the LDS1000 Controller is the same.

The computer sends a chain of characters to the controller that may then:

- Respond with a return chain.
- Carry out a modification or a function (without necessarily responding).
- Not respond and not react (message is not recognized).

The communication software must be able to generate ASCII messages (refer to syntax in the description of recognized commands).

It must also use a send command for this message on the current interface (refer to syntax in the supplier's instructions for the programming software).

It must then be able to read the return message or wait for this message (refer to syntax in the supplier's instructions for the programming software).

Finally, the message must be interpreted and the information contained in the chain of characters received must be recognized (values measured, sensor status, various parameters, …).

A properly structured program will include sub-programs that carry out these basic functions. Be particularly careful when writing these modules that are essential for the proper operating of the final program.

In all cases:

- The first order to be sent to the controller is the MR command that activates the controller in Interface Mode.
- If the communication is correct, the controller displays:

In other cases, check that:

- The controller is switched on.
- It is working in Main menu (if not cf. manual mode).
- The physical connection is correct.
- The communication parameters are correct.
- The syntax sent is correct.
- The initialization of the interface is properly carried out.

The reading sub-program should then be tested using, for example, the VE command which requests the software version of the LDS1000 Controller.

The response must be an ACSII chain of type:
VE LDS1000 CONTROLLER VERSION 3.0

If their is no response, carefully check the structure of the reading sub-program.

Structure of Messages to the Controller

The ASCII chains transmitted by the computer must match the commands understood by the LDS1000 Controller. Each message transmitted may include several different commands, separated by commas (,) or semicolons (;) and will end with the appropriate character (CR, LF, CRLF, LFCR). The <space> characters will be deleted on reception.

The core of each command is made up of two letters. For example:

MR: Set remote mode.

The parameters associated with the command are:

- Either the full digital values, preceding the command core. They usually indicate the address (or the number) where the information should be looked for. For example:

  42TT: Reading the measurement number 42.

- Or the decimal digital values, using a separating dot (.), according to the central core. They correspond to a value transmitted to the controller to modify the parameter concerned. For example:

  TM152: Launch the acquisition of 152 measurements.

The commands received by the controller are stored in a communication buffer of 255 characters. The controller carries them out chronologically by emptying this buffer memory.

The ASCII chains transmitted from the controller to the computer are the following:

- Generally they start by copying a part of the message sent.
- They are followed by the value or values of the response parameter.
- Commas are used to separate (,).

For example, when the **1TP** command is sent which requests the value measured on axis 1, the controller returns the chain:

1TP-1596.3 which indicates that the value measured on axis 1 is -1596.3.

Certain commands do not generate return from the LDS1000 Controller. For example, the **SP50** command that sets the sampling period at 50 msec.

Incorrect commands create an error. Only the last error code is stored in the memory. This code will be reset at @ (no error) when it is read again.

In every case, to find out whether the command has been correctly performed, test the status of the controller using the **TB** command (Reading the error).

The list of commands recognized by the LDS1000 Controller are given later in this manual. You are advised to read the description of a command carefully before using it.

Programming Conventions

- Access to Interface Mode is only driven by the computer (MR command).
- Access to Interface Mode is only possible if the controller is in its main menu.
- When the controller is in Interface Mode, none of the keys on the front panel are valid.
- The axes called Y and Z on the display correspond respectively to numbers 1 and 2 of the Interface Mode commands.
- The result matrices are numbered starting at 1. The first value in the memory is marked value 1.
- The measurements transmitted by the controller have the same format as the values displayed. They take into account the units used for the selected sensor.
- The Interface Mode output is activated by computer (ML command).

10.4 List of Commands

Commands Listed by Category

System Management

Command	Description
ML	Set Manual mode.
MR	Set Interface Mode.
RD	Frozen display.
RE	Active display.
RS	Reset system.
TB	Read error.
TE	Read error code.
TS	Read operational status.
VE	Read Soft version.

Reading Current Sensor Parameters

Command	Description
TA	Read current sensor parameters.
TN	Reading sensor number and series number.

Classical Acquisitions

Command	Description
KI	Define the integration constant.
TP	Read current measurement.
XI	Read integration constant.

Dynamic Acquisitions

Command	Description
MS	Read acquisition status.
SP	Define sample period
ST	Stop current acquisitions.
TK	Acquisitions with trigger on TRIG input.
TM	Immediate acquisitions.
TQ	Acquisitions with synchronization on TRIG input.
TT	Re-read acquisitions.
XN	Read number of measurements in memory.
XS	Read sample period.

Reading Logical Inputs/Outputs

Command	Description
RB	Read TRIGG input status.
RO	Read PWOK output status.

Commands Listed in Alphabetic Order

Command	Description
KI	Define the integration constant.
ML	Set Manual mode.
MR	Set Interface Mode.
MS	Read acquisition status.
RB	Read TRIGG input status.
RD	Frozen display.
RE	Active display.
RO	Read PWOK output status.
RS	Reset system.
SP	Define sample period.
ST	Stop current acquisitions.
TA	Read current sensor parameters.
TB	Read error.
TE	Read error code.
TK	Acquisitions with trigger on TRIGG input.
TM	Immediate acquisitions.
TN	Read sensor number and series number.
TP	Read current measurement.
TQ	Acquisitions with synchronization on TRIGG input.
TS	Read operational status.
TT	Proof read acquisitions.
VE	Read software version.
XI	Read integration constant.
XN	Number of measurements in memory.
XS	Read sample period.

10.5 Description of Commands

The rest of the manual presents the commands recognized in Interface Mode by the LDS1000 Controller. The format of one page per command is used to make it easier to look for the correct syntax.

The commands are listed in alphabetic order.

For each command, you will find the following information:

- The modes in which the following can be carried out (if not => error D):
  - **MNL** for manual mode.
  - **RMT** for remote mode (or Interface Mode).
  - **ACT** for active (acquisition in progress).
- Its syntax.
- Its parameters and the errors if they are incorrect.
- Its description.
- Its response.
- The related errors.
- An example.
- A comment if necessary.
- The commands related to that command.

KI Define the Integration Constant

Use ☐ MNL ■ RMT ☐ ACT

Syntax **KInn**

Parameter **nn** 0; 1; 2; 5; 10; 20; 50; 100; 200; 500; 1000.
Integration constant in msec with 0 = no integration =>0.5 msec).
Possible error
nn other than list below: nn takes nearest value.

Description Set the value of the integration constant INTG to nn msec.

Response None.

Error D Execution not allowed.

Example KI100 | *Define integration constant at 100 msec.*

NOTE

Do not confuse KI integration constant, and SP sample period.

The integration constant KI sets the duration of the digital averaging carried out on acquisitions to 2 kHz.

The sample period SP sets the time interval separating two successive measurements (related to commands TK, TM).

Related commands

SP	Define sample period.
TB	Read error.
TE	Read error code.
XI	Read integration constant.

ML Return to Local Mode

Use ☐ MNL ■ RMT ☐ ACT

Syntax **ML**

Parameter None.

Description End of remote mode and return to manual mode.

Response None.

Error D Execution not allowed.

Example ML | *Return to manual mode.*

NOTES

When returning from Interface Mode to Manual mode, the display returns to the Main menu, the keys on the front panel are active again, and the integration constant keeps the value possibly programmed by KI.

The parameters SP, TE, XN are set at the following values:

SP = 0, TE = @ and XN = 0.

Related commands

MR	Set Interface Mode.
RD	Frozen display.
RE	Active display.
TB	Read error.
TE	Read error code.

MR Set Interface Mode

Use ■ MNL ☐ RMT ☐ ACT

Syntax **MR**

Parameter None.

Description Set Interface Mode from Manual mode (manual mode in main menu).

Response None.

Error D Execution not allowed.

Example MR | *Set Interface Mode.*

REMARQUE

The controller then displays LDS1000 REMOTE MODE.

Related commands

ML	Set manual mode.
RD	Frozen display.
RE	Active display.
TB	Read error.
TE	Read error code.

MS Read Acquisition Status

Use ☐ MNL ■ RMT ■ ACT

Syntax **MS**

Parameter None.

Description Read acquisition status. The return value is an ASCII character the code of which should be translated into binary.

- Bit 0 = 0 : Correct power received.
  = 1 : Incorrect power received.
- Bit 1 = 0 : Correct position.
  = 1 : Incorrect position.
- Bit 2 = 0 : Acquisition not started up.
  = 1 : Acquisition started up - TRIGG wait.
- Bit 3 = 0 : No acquisition in progress.
  = 1 : Acquisition in progress.
- Bit 4 = 0
- Bit 5 = 0
- Bit 6 = 1
- Bit 7 = 0

Response **MSaa** aa is an ASCII character.

Errors

D	Execution not allowed.
S	Communication time-out.

Example

MS	|	*Read acquisition status.*
MS@	|	*System resting.*

Related commands

TB	Read error.
TE	Read error code.

RB Read TRIGG Input Status

Use ☐ MNL ■ RMT ■ ACT

Syntax **RB**

Parameter None.

Description Read the status of the TRIGG input. The return value will be equal to 0 or 1 depending on whether the interface is in high status or low status.

Response **RBnn** nn = status of TRIGG input.

Errors
D Execution not allowed.
S Communication time-out.

Example
RB | *Request status of TRIGG input.*
RB1 | *TRIGG input is in high status.*

Related commands
RO Read PWOK output status.
TB Read error.
TE Read error code.

RD Set Frozen Display Mode

Use ☐ MNL ■ RMT ■ ACT

Syntax **RD**

Parameter None.

Description Freezes the display on “REMOTE MODE” instruction to remove response times related to the display refresh.
This is the default display mode for Interface Mode.

Response None.

Error D Execution not allowed.

Example RD | *Frozen display. The controller displays:*

Related commands
RE Active display.
TB Read error.
TE Read error code.

RE Set Active Display Mode

Use ☐ MNL ■ RMT ■ ACT

Syntax **RE**

Parameter None.

Description Enable display in remote mode. The response times related to display refresh may appear.

Response None.

Error D Execution not allowed.

Example RE | *Active display.*

Related commands
RD Frozen display.
TB Read error.
TE Read error code.

RO Read PWOK Output Status

Use ☐ MNL ■ RMT ■ ACT

Syntax **RO**

Parameter None.

Description Read the status of the PWOK output. The return value will be equal to 0 or 1 depending on whether the interface is in high or low status.

Response **ROnn** nn = status of the PWOK output.

Errors
D Execution not allowed.
S Communication time-out.

Example
RO | *Request status of TRIGG input.*
RO0 | *The PWOK output is in low status.*

NOTE

The PWOK output is in status 1 if the sensor receives a sufficient quantity of light to carry out the measurement.

This logical output is available on the rear panel of the LDS1000 Controller.

Related commands
TB Read error.
TE Read error code.

RS Reset System

Use ☐ MNL ■ RMT ■ ACT

Syntax **RS**

Parameter None.

Description Stop work in progress and carry out a RESET on the LDS1000 electronic controller.

Response None.

Error D Execution not allowed.

Example RS | *Reset system.*

Related commands
TB Read error.
TE Read error code.

SP Define Sample Period

Use ☐ MNL ■ RMT ☐ ACT

Syntax **SPnn**

Parameter **nn** Sample period in milliseconds.
nn = 0.5 to 32000 msec, by steps of 0.5 msec.
Possible errors
nn absent + nn = 0.5 msec.
nn off limits + nn = Nearest authorized value.

Description Sets the sample period to nn milliseconds for TM and TK functions.

Response None.

Error D Execution not allowed.

Example SP50 | *Set the sample period to 50 msec.*

Related commands
TB Read error.
TE Read error code.
TK Acquisitions with trigger on TRIGG input.
TM Immediate acquisitions.

ST Stop Work in Progress

Use ☐ MNL ■ RMT ■ ACT

Syntax **ST**

Parameter None.

Description Stop work in progress (acquisition launched by TK, TM or TQ).

Response None.

Error D Execution not allowed.

Example ST | *Stop the work in progress and carry on.*

NOTE

The ST command stops the acquisitions in progress without deleting the memory. The measurements performed up to receiving this command are stored in the controller's memory.

The XN parameter keeps its value.

The command xxTT makes it possible to read the values stored if xx is lower than XN.

Related commands

TB	Read error.
TE	Read error code.
TK	Acquisitions with trigger on TRIGG input.
TM	Immediate acquisitions.
TQ	Acquisitions with synchronization on TRIGG input.
TT	Proof read acquisitions.
XN	Read number of measurements in memory.

TA Query Sensor Parameters

Use ☐ MNL ■ RMT ■ ACT

Syntax **xxTA**

Parameter **xx** Axis number: 1 for Y and 2 for Z.
Possible errors
xx ≠ 1 and xx ≠ 2 + Error B.

Description Read parameters of a current sensor axis:
TYPE : RT or TR.
COEF : 00100 to 29999.
INCR : 0,1; 0,2; 0,5; 1; 2; 5; 10; 20; 50.
UNIT : µrad; sec; mrad; nm; µm; mm; unit.
OFS1 : 00000 to 32767.
OFS2 : 00000 to 32767.
The parameters are separated by commas.

Response Sensor axis parameters.

Errors B Incorrect axis number.
D Execution not allowed.
S Communication time-out.

Example 1TA | *Read the parameters of axis 1 (Y) of the current sensor.*

Related commands **TB** Read error.
TE Read error code.

TB Error Description

Use ☐ MNL ■ RMT ■ ACT

Syntax **TBaa**

Parameter **aa** Error code in ASCII format (@ to U).
If there is no parameter + read current error.

Description Read message related to a an error code (parameter aa). Read current error message if aa is missing.

Response **TBaabb** aa = Error code queried.
bb = Error description.

Errors D Execution not allowed.
S Communication time-out.

Example TB@ | *Read error message @.*
TB@ No error | *No error.*

Related command **TE** Read error code.

TE Read Error Code

Use ☐ MNL ■ RMT ■ ACT

Syntax **TE**

Parameter None.

Description Read last error code generated by the LDS1000 Controller: ASCII character stored in error register.
The error register is reset when read with TB or TE.
Only the last error encountered can be read again.

Response **TEaa** aa = Current Error Code.
Error messages:
@ : No error.
A : Unknown message code.
B : Incorect axis number.
C : Parameters out of limits.
D : Execution not allowed.
O : Variable is out of range.
S : Communication time-out.

Errors

D	Execution not allowed.
S	Communication time-out.

Example

TE	|	*Read error code.*
TE@	|	*No error.*

Related command **TB** Read error.

TK Acquisition on External Trigger

Use ☐ MNL ■ RMT ☐ ACT

Syntax **xxTKnn**

Parameters

nn 1 at NBMAX. Number of measurements to be performed (NBMAX = Max. number of measurements related to the memory installed).

Possible error

nn outside authorized interval + Error C.

xx 1 to nn. Number of the measurement synchronized on trigger pulse (TRIGG input).

Possible error

nn outside authorized interval + Error O.

Description

Performs an acquisition of nn measurements, as the measurement xx is synchronous with the trigger signal (the acquisitions are stored in a revolving memory of xx values while awaiting trigger signal).

The acquisition period is given by SP.

The integration constant set by KI is used.

The number of the acquisition in progress is given by XN.

XN remains equal to zero while the trigger signal is absent, then Xn directly takes the value xx.

If the trigger signal arrives before xx measurements are stored in the memory, the first values will be set at MIN, MIN being the lowest limit of the measurement range of the sensor used.

Response None.

Errors

C	Parameter out of limit.
D	Execution not allowed.
O	Variable is out off range.

Example 20TK100 | *Pre-launch the acquisition of a series of 100 measurements.*

Measurements 1 to 19 precede the trigger signal, measurement 20 is synchronous with this signal and measurements 21 to 100 come after it.

NOTE

The trigger signal is an external logical signal, that must be connected to the TRIG input located on the rear panel of the LDS1000 Controller.

Related commands

KI	Define the integration constant.
TB	Read error.
TE	Read error code.
SP	Define sample period.
XN	Read number of measurements in memory.

TM Immediate Acquisition

Use ☐ MNL ■ RMT ☐ ACT

Syntax **TMnn**

Parameter **nn** 1 at NBMAX. Number of measurements to be performed (NBMAX = Max. number of measurements related to the memory installed).

Error possible

nn outside authorized interval + Error C

Description Immediately carries out an acquisition of nn successive measurements.

The acquisition period is given by SP.

The integration constant set by KI is used.

The number of the acquisition in progress is given by XN.

XN is equal to nn when the series of acquisitions is finished.

Response None.

Errors

C	Parameter out of limit.
D	Execution not allowed.

Example TM100 | *Launch the acquisition of a series of 100 measurements.*

Related commands

KI	Define the integration constant.
TB	Read error.
TE	Read error code.
SP	Define sample period.
XN	Read number of measurements in memory.

TN Read Number of Selected Sensor

Use ☐ MNL ■ RMT ■ ACT

Syntax **TN**

Parameter None.

Description Read number of sensor selected by the user.

Response **TNxx,yy** xx is the number of the selected sensor (0 to 9).

yy is its series number.

Errors

D	Execution not allowed.
S	Communication time-out.

Example

TN | *Request the number of the sensor selected.*

TN5,151232 | *Sensor number 5 is selected, its series number is 151232.*

Related commands

TB	Read error.
TE	Read error code.

TP Read Current Position

Use ☐ MNL ■ RMT ■ ACT

Syntax **xxTP**

Parameter **xx** Number of axis to be read (xx = 1 for Y and xx = 2 for Z).
xx missing or xx ≠ 1 and xx ≠ 2 + Read two axes.

Description Read current position.

Response **xxTPnn** or
1TPnn1,2TPnn2

Errors D Execution not allowed.
S Communication time-out.

Example TP | *Request position.*
1TP4.5,2TP1254.6 | *Y = 4.5 and Z = 1254.6.*

Related commands **TB** Read error.
TE Read error code.

TQ Acquisition on External Signal

Use ☐ MNL ■ RMT ☐ ACT

Syntax **TQnn**

Parameter **nn** 1 at NBMAX: number of measurements to be performed (NBMAX = max. number of measurements related to the memory installed).
Possible error
nn outside authorized interval + Error C

Description Performs an acquisition of nn measurements triggered by an external signal wired to the TRIGG input (active on upward front).
The integration constant set by KI is used.
The number of the acquisition in progress is given by XN.

Response None.

Errors C Parameter out of limit.
D Execution not allowed.

Example TQ10 | *Launch the acquisition of 10 measurements triggered by an external (TRIGG input).*

NOTE

This external input can be a simple push button without rebound, which enables the operator to carry out the measurements at the most appropriate moment.

Related commands

KI	Define the integration constant.
TB	Read error.
TE	Read error code.
TK	Acquisitions with trigger on TRIGG input.
XN	Read number of measurements in the memory.

TS Read Operational Status

Use ☐ MNL ■ RMT ■ ACT

Syntax **TS**

Parameter None.

Description Read acquisition status. The return value is an ASCII character the code of which should be translated into binary:

- Bit 0 = 0 : Standard memory.
  = 1 : Extended memory.
- Bit 1 = 0 : Frozen display mode.
  = 1 : Refreshed display mode.
- Bit 2 = 0
- Bit 3 = 0
- Bit 4 = 0
- Bit 5 = 0
- Bit 6 = 1
- Bit 7 = 0

Table for reading messages received:

@	: Standard memory (2048) and frozen display.
B	: Standard memory(2048) and active display.
A	: Extended memory (14336) and frozen display.
C	: Extended memory(14336) and active display.

Response **TSaa** aa is an ASCII character.

Errors

D	Execution not allowed.
S	Communication time-out.

Example

TS	|	*Read operational status.*
TS@	|	*Standard memory and frozen display.*

Related commands

TB	Read error.
TE	Read error code.

TT Read Measurements Saved

Use ☐ MNL ■ RMT ■ ACT

Syntax **xxTT**

Parameter **xx** Number of the acquisition to be proof read.
xx = 0 to MAX (MAX = value returned by XN).
Possible error
xx missing + xx = 0.
xx outside authorized interval + Error C.

Description This command enables the measurements saved to be read again following a TK, TM or TQ command.
If xx is a whole number other than nil within the authorized interval, the controller returns the value of the measurement xx. If xx = 0 or absent, the controller returns all the measurements in the memory (one measurement Y, Z per line starting with the number 1).
In RS-232-C mode there is a 25-msec pause between two successive lines (response at TT or 0TT) to avoid overflow.
Reading is possible as soon as the acquisitions have begun.

Response **xxTT,1TPnn1,2TPnn2**

Errors

C	Parameter out of limit.
D	Execution not allowed.
S	Communication time-out.

Example

9TT	*Read measurement number 9.*
9TT,1TP12.2,2TP258.1	*Measurement number 9: Y = 12.2 and Z = 258.1.*

Related commands

TB	Read error.
TE	Read error code.

VE Read Internal Program Version

Use ☐ MNL ■ RMT ■ ACT

Syntax **VE**

Parameter None.

Description Read internal program version of the controller.

Response **VE LDS1000 Controller Version xx.yy**
xx = Version.
yy = Progress index.

Errors
D Execution not allowed.
S Communication time-out.

Example
VE | *Read program version.*
VE *LDS1000 Controller Version 3.10* | *Program version 3.10.*

Related commands
TB Read error.
TE Read error code.

XI Read Integration Constant

Use ☐ MNL ■ RMT ■ ACT

Syntax **XI**

Parameter None.

Description Read integration constant given in milliseconds.

Response **XInn** nn is the integration constant given in milliseconds.

Errors
D Execution not allowed.
S Communication time-out.

Example
XI | *Read integration constant.*
XI100 | *The integration constant is equal to 100 msec.*

Related commands
KI Define the integration constant.
TB Read error.
TE Read error code.

XN Read Number of Stored Measurements

Use	☐ MNL ■ RMT ■ ACT	
Syntax	**XN**	
Parameter		None.
Description		Read number of measurements available in the memory.
Response	**XNnn**	The memory contains nn measurements.
Errors	D	Execution not allowed.
	S	Communication time-out.
Example	XN	*Read number of available measurements.*
	XN100	*The memory contains 100 measurements.*
Related commands	**TB**	Read error.
	TE	Read error code.
	TK	Acquisitions with trigger on TRIGG input.
	TM	Immediate acquisitions.
	TQ	Acquisitions with synchronization on TRIGG input.
	TT	Re-read acquisitions.

XS Read Sample Period

Use	☐ MNL ■ RMT ■ ACT	
Syntax	**XS**	
Parameter		None.
Description		Read sample period.
Response	**XSnn**	The sample period is nn milliseconds.
Errors	D	Execution not allowed.
	S	Communication time-out.
Example	XS	*Read sample period.*
	XS2.5	*The sample period is equal to 2.5 ms (400 Hz).*
Related commands	**TB**	Read error.
	TE	Read error code.
	SP	Define sample period.

10.6 Error Messages

Error messages are available in a specific memory of the LDS1000 Controller, in reply to the TE or TB message sent by the interface.

Character	Description
@	No error.
A	Unknown message code.
B	Incorect axis number.
C	Parameters out of limits.
D	Execution not allowed.
O	Variable is out of range.
S	Communication time-out.

Reading the error message resets the error memory to @.

10.7 Examples of Messages

The chain transmitted can be the second part of a command separated by a comma or a semi-colon.

KI100;SP1000;TM100

Acquisition of 100 points with a period of 1000 msec and an integration constant of 100 msec.

KI0;SP5;10TK100

Acquisition of 100 points with a period of 5 msec without integration. The acquisition is synchronized on the TRIGG input so that the measurement number 10 is synchronous with the setting to high status of this input.

KI1000;TQ100

Acquisition of 100 points with an integration constant of 1000 msec. Each acquisition is triggered by setting the TRIGG input from 0 to 1.

10.8 Examples of Programs (Quick Basic by Microsoft)

Example with RS-232-C Interface

The RS-232-C interface is used to connect the LDS1000 Controller to a computer or a console.

The controller manages the RS-232-C interface like a three-wire interface: only the send and receive lines are used as well as the mass.

This controller manages all the interface parameters that must be set at the same values for the LDS and the computer (refer to the configuration chapter).

The following parameters are selected by default:

- BAUD RATE : 9600
- MSG TERM : CR
- WORD LENGTH : 8
- STOP BITS : 1
- PARITY : NONE

A higher rate can be obtained with BAUD RATE = 19200 if the computer can bear it.

The CR terminator is the basic default terminator.

The example program “LDSRS1” is an example of programming in Quick basic Microsoft.

It demonstrates how to:

- Open the interface with the appropriate parameters.
- Set the controller to remote mode.
- Send a command and wait for the response.
- Read the response and convert the ASCII chain received into digital values.
- Return to local mode.

RECOMMANDATION

Refer to the Appendix A: “Example of Program Using RS-232-C Link”.

Example with IEEE-488 Interface

Contrary to the RS-232-C interface, the IEEE-488 interface does not equip computers in standard state.

This interface requires a special card that is included in the computer.

This card is supplied with library of functions that must be chained with the program developed.

Refer to the card documentation to correctly perform the material configuration [IEEE-488 card/Computer].

Three program parameters must be related between the controller and the computer:

- Chain terminator : MSG TERM (CR LF by default).
- Primary address : PRIM ADRESS (00 by default).
- Secondary address : SECOND ADRESS (15 by default).

The CR LF terminator is the default terminator of the IEEE-488 card.

The controller manages the IEEE-488 interface in SRQ mode: the SPOL function of the IEEE card enables the controller status to be read. This status is coded in one word of 8 bits, bit 6 of which(value 64) is worth 1 if a message is near: reading must always by done before a new request.

RECOMMANDATION

Refer to the Appendix B3: “SRQ Using”.

11.0 Maintenance

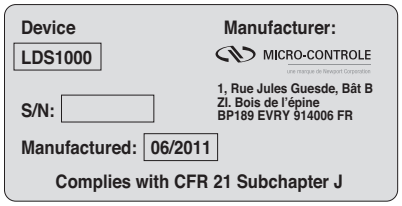
11.1 Optical Head

CAUTION: LASER SAFETY

LDS Series Sensors are CLASS II LASER INSTRUMENTS according to the EN 60825-1 standard:

DO NOT STARE INTO BEAM

Max. Power <1 mW @ 670 nm



Any other intervention requiring dismantling of all or part of the equipment must be carried out by our maintenance service.

11.2 Maintenance of the LDS1000 Electronic Controller

WARNING

Certain safety precautions must be respected before any intervention on the LDS1000 Controller.

In order to comply with the safety standards for the use of this equipment, the user must take the necessary precautions and respect the warnings that appear in the chapter entitled "Warnings".

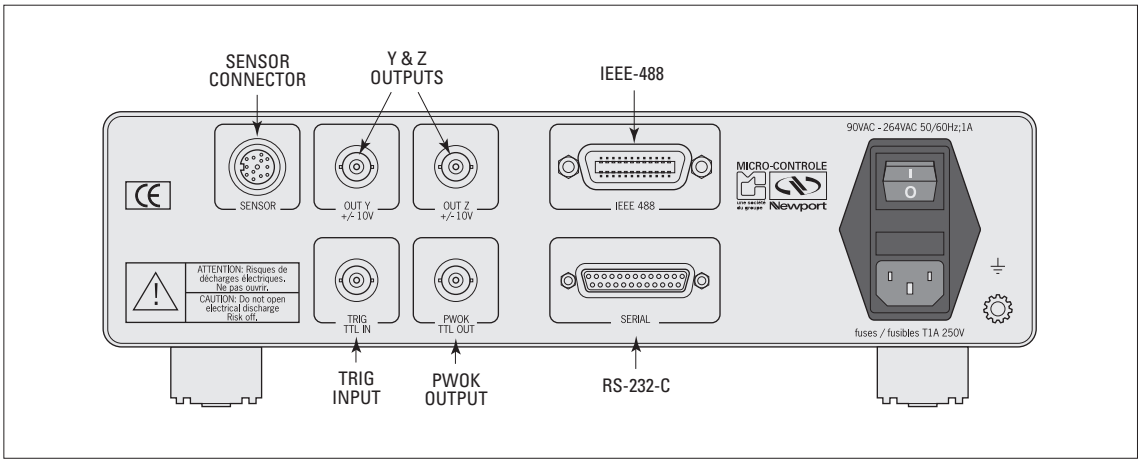
The LDS1000 electronic controller is designed to receive signals from an LDS-Vector autocollimator. The following precaution are necessary if it is to work correctly:

- Make sure that the mains current matches the characteristics of the autocollimator.
- Make sure that the mains plug is grounded.
- Do not cause a short-circuit between the connector terminals of the communication.
- Use the cables supplied by NEWPORT.
- Cut the power supply to the controller when making a connection.
- Do not connect the BNC terminals of the logical inputs/outputs to an electric power supply.
- Do not try to connect a sensor other than the one supplied by NEWPORT.

Maintenance

Clean the electronic controller with a soft cloth and a little alcohol while powered off.

11.3 Cables



RS-232-C Cables

WARNING

Use a standard commercial cable, or the cable supplied with the DLS1000 Controller (sheathed cable that is <3 meters in length).

LDS1000 Sub-D25 male	Computer Sub-D9 femal
2 (TxD)	**3** (TxD)
3 (RxD)	**2** (RxD)
7 (GND)	**5** (GND)

or

LDS1000 Sub-D25 male	Computer Sub-D25 femal
2 (TxD)	**2** (TxD)
3 (RxD)	**3** (RxD)
7 (GND)	**7** (GND)

IEEE-488 Cable

WARNING

Use a standard commercial cable.

Sensor Interface Cable: “SENSOR” Connector

WARNING

Only use the cable supplied with the NEWPORT LDS-Vector.

Analog Output Cables: “OUT Y” & “OUT Z” Connectors

WARNING

Use sheathed commercial cables that are <3 meters in length.

Measurement Synchronization Input Cable: “TRIG” Connector

WARNING

Use sheathed commercial cable that is <3 meters in length.

Beam Signal Output Cable: “PWOK” Connector

WARNING

Use sheathed commercial cable that is <3 meters in length.

12 Appendices

A Example of Program Using RS-232-C Link

```
'LDS1000 EXAMPLE SOFTWARE, Microsoft Quick Basic V4.5

CLS

'initialisations RS-232 COM 1 with standard parameters

CHAINE$ = "COM1:9600,N,8,1,CS,DS,CD,OP3000"
OPEN CHAINE$ FOR RANDOM AS #1

'LDS1000 in remode remote

ev$ = "MR"
PRINT #1, ev$

'Example: Loop on Position Reading

env$ = "TP"
LOCATE 5, 10: PRINT "LAERS1 exemple software "
LOCATE 18, 10: PRINT "Hit any key to abort "
WHILE INKEY$ = ""

' send TP

PRINT #1, env$

' wait answer

WHILE LOC(1) = 0: WEND

' read LA510 answer
LINE INPUT #1, ret$

' conversion ASCII => numerical values

msge$ = MID$(ret$, 4)
comma = INSTR(msge$, ",")
posy$ = LEFT$(msge$, comma - 1)
posz$ = MID$(msge$, comma + 4)
posyn = VAL(posy$)
poszn = VAL(posz$)

' print result

LOCATE 10, 10: PRINT "LAE510 message: "; ret$
LOCATE 12, 20: PRINT " Y value: ";
LOCATE 12, 30: PRINT USING "+######.##"; posyn
LOCATE 13, 20: PRINT " Z value: ";
LOCATE 13, 30: PRINT USING "+######.##"; poszn

WEND

'LDS1000 in local mode

ev$ = "ML"
PRINT #1, ev$

END
```

B IEEE-488 Link Characteristics

NOTE

In order to meet FCC emission limits for a Class B device, you must use a double shielded IEEE-488 cable. Operating this equipment with a single shielded cable may cause interference to radio and television reception in residential areas.

NOTE

Comply to IEEE Standard Digital Interface for Programmable Instrumentation.

ANSI/IEEE Std. 488 - 1978. This norm is commonly called IEEE-488.

B.1 IEEE-488 Functions Supported by LDS1000 Controller

Mnemonic	Definition	Support
ATN	Attention	Yes
DCL	Device Clear	Yes
EOI	End or Identify	Yes
EOL	End of Line	Yes
GET	Group Execute Trigger	No
GTL	Go to Local	No
IFC	Interface Clear	Yes
LAD	Listen Address	Yes
LLO	Local Lockout	No
OSA	Other Secondary Address	No
PPC	Parallel Pol Configure	No
PPD	Parallel Poll Disable	No
PPE	Parallel Poll Enable	No
PPU	Parallel Poll Unconfigure	No
REN	Remote Enable	No
SDC	Selected Device Clear	Yes
SPD	Serial Poll Disable	No
SPE	Serial Poll Enable	Yes
SRQ	Service Request	Yes
TAD	Talk Address	Yes
TCT	Take Control	No
UNL	Unlisten	Yes
UNT	Untalk	Yes

B.2 IEEE-488 Function Subsets

This controller support the many GPIB function subsets, as listed bellow. Some of the listings described subsets that the controller does not support.

C0 (Controller). The LDS1000 can not control other devices.

T5 (Talker). The LDS1000 becomes a Talker when the CIC (Controller In Charge) sends its TAD (Talker Address) with the ATN (Attention) line asserted. It ceases to be a talker when the CIC (Controller In Charge) sends another device's TAD (Talker Address) with ATN (Attention) asserted.

L4 (Listener). The LDS1000 becomes Listener when the CIC (Controller In Charge) sends its LAD (Listener Address) with the ATN line asserted. The LDS1000 does not have Listen Only capability.

SH1 (Source Handshake). The LDS1000 can transmit multiline messages accros the GPIB.

AH1 (Acceptor Handshake). The LDS1000 can receive multiline messages accros the GPIB.

SR1 (Service Request). The LDS1000 asserts SRQ (Serial Request) line to notify the CIC (controller In Charge) when it requires service.

RL0 (Remote / Local). The LDS1000 does not support the GTL (Go To Local) and LLO (Local Lock Out) functions.

PP0 (Parralel Poll). The LDS1000 has no Parallel Poll capability. It does not respond to the following interface messages: PPC, PPD, PPE and PPU. The LDS1000 does not send out a message when the ATN (Attention) and EOI (End or Identify) line are asserted.

DC1 (Device Clear). The LDS1000 responds to the DCL (Device Clear) and, when made Listener, the SDC (Selected Device Clear) interface message.

DT0 (Device Trigger). The LDS1000 does not support GET (Group Execute Trigger) interface message.

E2 (Electrical). The LDS1000 uses tristate buffers to provide optimal high-speed data transfer.

B.3 SRQ Using

The NI488.2 User Manual for Windows from National Instruments, in the GPIB Programming Techniques chapter describes the use of Serial Polling as follow (page 7-5):

Serial Polling

You can use serial polling to obtain specific information from GPIB devices when they request service. When the GPIB SRQ line is asserted, it signals the Controller that a service request is pending. The controller must then determine which device asserted the SRQ line and respond accordingly. The most common method for SRQ detection and servicing is serial poll. This section describes how you can set up your application to detect and respond to service requests from GPIB devices.

Service Requests from IEEE-488 Devices

IEEE-488 devices request service from the GPIB Controller by asserting the GPIB SRQ line. When the Controller acknowledge the SRQ, it serial polls each open device on the bus to determine which device requested service. Any device requesting service returns a status byte with bit 6 set and then unasserts the SRQ line. Devices not requesting service return a status byte with bit 6 cleared. Manufacturers of IEEE-488 devices use lower order bits to communicate the reason for the service request or to summarize the state of the device.

Service Requests from IEEE-488.2 Devices

The IEEE-488.2 standard redefined the bit assignments in the status byte. In addition to setting bit 6 when requesting service, IEEE-488.2 devices also use two other bits to specify their status. Bit 4, the Message Availiable Bit (MAV), is set when the device is ready to send previously queried data. Bit 5, the Event Status Bit (ESB), is set if one or more of the enabled IEEE-488.2 events occurs. These events include power-on, user request, command error, execution error, device-dependant error, querry error, request control and operation complete. The device can assert SRQ when ESB or MAV is set, or when a manufacturer-defined condition occurs.

Also on page 7-7, National instruments give an example on how to conduct a serial poll:

SRQ and Serial Polling with NI-488 Device Functions…

The following example illustrates the use of the ibwait and ibrsp functions in a typical SRQ servicing situation when automatic serial polling is enabled.

```
#include "decl.h"

char GetSerialPollResponse (int DeviceHandle)
{
char SerialPollResponse = 0;

ibwait (DeviceHandle, TIMO | RQS);
if (ibsta & RQS)
{
printf ("Device asserted SRQ.\n");
/* Use ibrsp to retrieve the serial poll response. */
ibrsp (DeviceHandle, &SerialPollResponse);
}
return (SerialPollResponse);
}"
```

The LDS1000 Controller is an IEEE-488 device in which the SRQ is always enable. It will respond accordingly to the National Instruments example. When the queried data will be ready, the LDS1000 will assert the SRQ line and, in the serial poll response bit 6 will be set (Requesting service) and bit 7 (manufacturer-defined) will be set (Message Availiable). After that you can use the ibrd command to retreive the data from the LDS1000.

Service Form

Your Local Representative
Tel.: _____
Fax: _____

Name: _____ Return authorization #: _____
(Please obtain prior to return of item)

Company: _____

Address: _____ Date: _____

Country: _____ Phone Number: _____

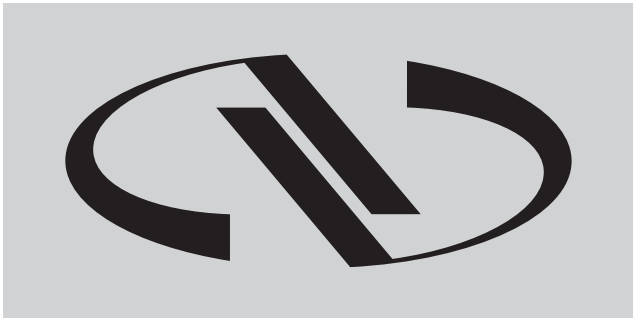
P.O. Number: _____ Fax Number: _____

Item(s) Being Returned:

Model #: _____ Serial #: _____

Description: _____

Reasons of return of goods (please list any specific problems): _____



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